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WITH WHICH ARE INCORPORATED

ALUMINUM WORLD & COPPER AND BRASS

BRASS FOUNDER and FINISHER

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X-Rays' Place in the Non-Ferrous Metal Industry

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X-Ray Examination By Film, Paper or Visual Inspection. Aid in Selling and Production

ABOUT five years ago the writer introduced X-rays to the readers of this journal (June, 1928) so that the subject is not entirely new. Naturally, much progress has been made since, and today we have a number of very definite applications in the non-ferrous industry where X-ray inspection has a valuable and permanent place. To describe all of these applications would lead too far, and we must restrict ourselves to a few, which apply to practically any manufacturer and user of non-ferrous metal products.

Before doing so, we want to recall briefly that X-ray examination of non-ferrous metal objects can be done in three different ways:

1. Radiographic examination with photographic film.
2. Radiographic inspection with photographic paper.
3. Visual inspection on a fluorescent screen.

Photographic Film

Radiographic examination with photographic film is the most sensitive way to obtain a permanent record and likewise the most rapid of these three, but it is the most expensive one. It may show fine cracks which will not be visible on the photographic paper and certainly, not be detectable on a fluorescent screen. This is particularly true in the case of brass and bronze materials which are less transparent to X-rays than light metals, since the penetrating power of the rays decreases with increasing atomic weight. The film practice is recommended for all research work.

Photographic Paper

For production development and check up inspection the photographic paper is perfectly satisfactory. On high atomic materials we may have to tolerate a slightly longer exposure time which in most cases is offset by the cheaper cost of the paper. All white metal alloys should be X-rayed on paper. We have found that we obtain sharper outlines around edges, for instance, on paper than we do on film, due to the scattering around these edges. Since paper is not quite as sensitive as film, this scattering effect is reduced to a minimum on paper, and small defects within the material toward the edges may not show up on the film on account of the fogging, but will be detected on paper. The chief factor in favor of paper, however, is the fact that the cost is about one third of that of X-ray film.

The appearance of the various defects is almost the same for different materials and can be raised up to one per cent precision in radiographic work with film or paper in thicknesses up to an inch, and above one inch to about 2%. This holds good for defects which lie in the direction of the rays. Defects of about 4% of the total thickness of material can be detected visually on a fluorescent screen.

Visual Inspection

Visual inspection is most often employed for checking up on routine production and is of special value where material is supplied on a certain permissible percentage of porosity. This method is inexpensive and rapid but relies on the momentary judgment of the operator and there is no permanent record. At the present time, this method is limited by the thickness of the material. Four inches of aluminum can just be observed on the screen, whereas one quarter of an inch of brass is the limit for the copper alloys. Before long we may have photo-electric cells which are more sensitive than the human eye and they will be able to detect defects which we cannot see on the screen at present.

As with ordinary photographs, darker regions on the

negative (photographic paper) or lighter regions on the print (from film) mean that more X-rays have passed through the object at that point which indicates that the material is more transparent there. Hence cavities will show up in the negative as dark spots whereas heavy impurities or more dense metal will appear lighter.

X-Ray Photos as Sales Aids

With this in mind, there will be no difficulty in interpreting the X-ray picture shown in figure 1. It represents an aluminum frying pan X-rayed on paper. Large blow holes, fine porosity and some cracks are plainly visible. There is some porosity noticeable toward the edges and in the heavier sections. These latter defects were obscured in the same picture on film. Cooking utensils like this one represent cases where it would pay the manufacturer to inspect each piece on the fluorescent screen before they are being shipped. Defects like the ones present in the frying pan cause leakage after a short while in service and consequently complaints with probable loss of a customer. They certainly do not help to "sell" the public on aluminum ware. It is perfectly feasible with the cheaper photographic paper available to furnish with each utensil the actual X-ray picture of this particular piece, thus removing all doubt from a buyer's mind and showing him proof of the perfect article he is

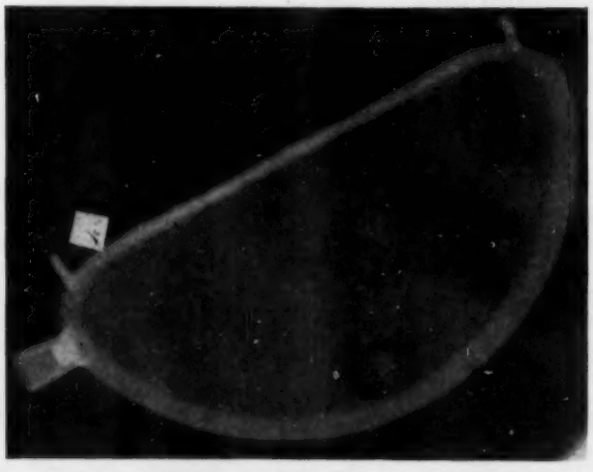

Fig. 1. Aluminum Frying Pan X-Rayed on Paper

purchasing. There will not be any complaints afterwards and repeat orders will come in frequently, because the customer is satisfied and will always ask for the same article again, knowing that he is spending his money on perfectly sound material which will give him no trouble in service. We are not treating this subject commercially, so we mention only briefly the enormous advertising value of such a picture accompanying the sale of an article.

In some cases it may be sufficient for the salesman to show a collection of photographs and X-ray pictures of the same article, in order to convince a skeptical customer that the material he is purchasing is perfectly sound. Die casting manufacturers found it very desirable to convince their prospective clients in that way. Figure 2 illustrates this point by showing a photograph of a good looking article and the X-ray picture of the sound inside. This procedure, however, will lead to difficulties unless backed up by actual performance. Should the customer find out that the salesman's picture is just an exception and above the standard quality he receives, why, the consequences will be worse than if the client would not have seen the perfect picture.

X-Rays as Foundry Aids

It is, however, easy for a foundryman, for instance, to live up to his promises. All he has to do is follow the correct procedure. In order to improve the quality of his products or when starting a new mold, select at least

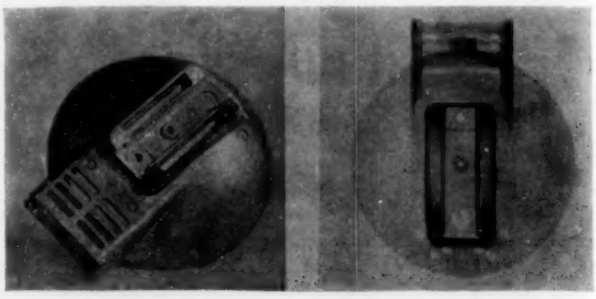

Fig. 2. Photograph and X-Ray of Sound Die Casting

three specimens cast in the same mold and X-ray these. Any defects characteristic of the casting technique will be likely to appear in all three pictures. In comparing the pictures with the mold, foundrymen are able to find easily the causes for interior defects. The necessary changes in form or position of gates and air vents or other parts of the mold, are determined and made. Have another group of castings made by the new technique, X-rayed, and proceed in this way until satisfactory castings can be secured from the mold. It should not take more than two X-ray examinations to obtain a perfect mold. This procedure proved especially valuable on pilot castings before a new mold is put into production operation. In most of the cases where X-ray inspection has been employed, it has proved cheaper and ever so much more satisfactory, in saving time and money, than the ordinary and old-fashioned way of cutting up castings and all similar ways of checking production. The X-ray picture shows the conditions throughout the piece without destroying or in any way harming it and gives a permanent record. After defective conditions are corrected once, they tend to stay corrected.

Beryllium-Copper

Beryllium, the newest of our important alloying metals, was discussed by W. H. Bassett, of the American Brass Company, Waterbury, Conn., at a meeting of the New York Section of the Institute of Mining & Metallurgical Engineers on January 25, 1933. He confined himself mainly to the copper alloys. Much is now expected of these alloys because of their valuable property of precipitation hardening. The price of beryllium in alloyed state has dropped from $50 per pound, in 1930, to $25, with prospects of a further reduction to $10 or even less, with increasing consumption.

The effect of beryllium becomes apparent at 1.3 per cent and reaches a maximum at about 2.25 per cent, which is now the standard composition. Above this figure ductility diminishes. The increase of strength is illustrated by the fact that the 2.25 per cent alloy, has a tensile strength of 55,000 lbs., and after heat-treatment has a tensile strength of 155,000 lb. Cold-worked specimens, with tensile strength of 110,000 lb., may show tensile strengths of 175,000-200,000 lb. after proper heat-treatment. Another feature is the high electrical conductivity, compared with bronzes of equal strength.

Fluxes in Brass Melting

By WERNER FRÖHLICH
Brass Melter, Potsdam, Germany

A Review of the Many Fluxes in Use, Their Purposes and Their Limitations—Conclusion*

Common Salt—Sodium Chloride

A COMMON flux, particularly in continental foundries, is crude salt (sodium chloride) which is a fairly good solvent of metallic oxide besides forming a satisfactory protecting cover. It is not as efficient as borax or boric acid in this respect but its costs are relatively low and it may therefore be used in crucible melting where the cheaper grades of brass alloys are produced. An outstanding property of salt covers is their solvent action on copper oxide, but since this is taken care of by the zinc, or by the phosphor copper added previous to zinc, this property is of little practical importance. It is also claimed to exhibit a tendency towards dissolving antimony and arsenic. Crude table salt fluxes are particularly suited for the melting of brass alloys high in copper, zinc, tin, antimony or, eventually bismuth. For normal alloys, that is to say, for brasses containing from 30 to 35 per cent zinc and but small percentages of special constituents glass slags are perfectly satisfactory. Where on account of comparatively large percentages of secondary material in the charges correspondingly large amounts of phosphor copper must be employed to attain the necessary degree of deoxidation, fluxes containing considerable quantities of plaster of paris are employed, a commonly used mixture of this type being composed of equal parts of plaster of paris, crude table salt, and calcined soda. If melting is carried out in graphite crucibles the calcined soda should be left out in order to avoid rapid corrosion of the lining.

"Reducing" Fluxes

Of the so-called "reducing fluxes" the chief property of which appears to be their solvent action on metallic oxides, potassium bisulfate is the most commonly employed. As a rule, these fluxes possess little covering action and they must therefore be used in conjunction with materials exhibiting this property to a more pronounced degree. Potassium bisulfate is usually employed mixed with a large excess of ground charcoal. One ounce of the salt per 100 lbs. suffices where virgin metals are used in the production of brass. The larger the proportion of scrap used and the more pronounced its state of oxidation, the larger the amount of bisulfate required, of course, but 4 oz./100 lbs. will suffice for most purposes. Half of the total amount of salt employed should be placed in the crucible (together with about 1 lb. of charcoal) before charging the metal, the rest of the mixture being added after the charge has liquefied. As a protective cover borax, salt, or plaster of paris is used, although common glass scrap will doubtlessly give equally good results. Plaster of paris is generally preferred in America, while crude table salt or glass scrap is employed in Germany. If the latter is used, the whole of the bisulfate mixture should be charged previous to the metal.

In using potassium bisulfate there is a certain, although slight, contamination of the brass with sulfur. Where an increase of the sulfur contents of one or two hundredth per cent does not matter this may be ignored, in the other case one or two washing treatments with calcined soda have to be applied previous to casting.

Much has been written and debated concerning the advisability of melting brass alloys, or copper alloys in general, under reducing conditions. While the oxidation of metals may be maintained at a minimum by rendering the nature of slags and furnace atmospheres distinctly reducing, this treatment has the disadvantage of introducing gases such as hydrocarbons, nitrogen and hydrogen into the metal, rendering it porous and weak. It is a well-known fact, however, that if gassed metal is remelted under neutral or slightly oxidizing conditions it would become perfectly sound, provided care is taken to remove the oxides by the usual methods.

Instead of employing "reducing fluxes," "oxidizers" may therefore be of good service where the alloys produced are not too high in zinc. Nitrates, manganese dioxide and other oxidizing agents are occasionally found in foundry slag mixtures and the success obtained with them testifies to their value. A. Portevin[3] applied this principle in another way. For instance, in producing an alloy containing a small quantity of lead he introduced oxide of lead in the form of litharge (PbO), or better still, red lead (Pb_3O_4) in a sufficient quantity to allow the right amount of lead in the final mix, taking into account the reduction looked for. The method of proceeding was as follows: the metallic bath of about 650 lbs. was melted and maintained at proper temperatures; the surface was skimmed and sprinkled with about 0.5 per cent of red lead; the melt was then stirred and casting proceeded with as usual. This process has been carried on for years, excluding the trouble formerly experienced with gas porosities. Apart from the various types of general fluxes above indicated, there are number of special mixtures used to obtain certain effects such as the complete or partial removal of undesirable constituents of the brass or, on the other hand, improving the absorptive capacity of the brass melts for other metals.

Removing Impurities

Of special technical and economic importance may be considered the removal of aluminum, silicon and iron from secondary brasses without at the same time oxidizing too much zinc or other important alloying constituents.

* Part 1 was published in our March issue.

[3] The "Metal Industry," London, May, 1924, pp. 421/2.

Aluminum and silicon may be removed in larger percentages by oxidation only. The use of copper oxide scales frequently suggested for the removal of aluminum is impracticable in the case of brass alloys since in spite of the very strong affinity of aluminum for oxygen it cannot be removed in considerable quantities by the addition of copper scales without oxidizing most of the zinc also. It is necessary, therefore, to operate with fluxes, the oxidizing influence of which is limited only to certain metals without appreciably touching the zinc or tin constituents. The only chemicals of this type known to answer this purpose are the sulfates of the alkalies or of the alkaline earths, the most practical member of these groups being potassium sulfate. For the metallurgical purposes in question the crude sulfate produced as a by-product in the nitric acid manufacture is employed; this has to be carefully dried before application.

After melting down the metal under one of the common fluxes mentioned, the metallic bath is slagged off, and sufficient quantities of dried, crude potassium sulfate sprinkled over the metal surface to make a dense cover. The period of washing depends upon the percentage of the impurities to be removed as well as on the type of furnace (depth of bath, etc.), and the amount of metal treated. Where large quantities of similar metal are to be treated by this method, the correct amount of sulfate and period of washing may be determined by experiment.

This process carries with it the disadvantage of introducing small amounts of sulfur into the bath. While the percentages in question are usually somewhat higher as in the case of the bisulfate treatments above mentioned, they are not prohibitive in ordinary brasses. Where minimum sulfur contents are specified, washings with calcined soda-charcoal mixtures will have to be applied previous to casting.

The iron contents of brass alloys may be considered from two points of view. With considerable percentages of iron—added intentionally or present as impurity—it is usually considered sufficient to maintain the iron in its metallic, soluble state, thus preventing the formation of iron-carbide which on account of its extreme hardness renders the brass alloys unfit for cutting treatments. Soluble metallic iron is easily converted into the carbide by the carbonaceous components of the furnace gases, the best fluxes to prevent this being silicates, while iron carbide may be introduced with impure scrap. In either case it is necessary to decompose it where the product is later to be subjected to machining.

There are two processes now in use, a slagging treatment with quartz-soda mixtures and a chemical treatment with mercuric chloride. On account of the poisonous vapors generated by mercuric chloride, the latter process should be applied only where satisfactory provisions have been made for rapid exhaustion of all the gases formed, but since the results obtained are hardly superior to those effected with the slag treatment, and since the employment of mercuric chloride offers no other practical advantages, this process will hardly find general application.

The slag mixture employed in the other process consists of equal parts of powdered quartz and calcined soda, the total quantity used amounting to about 3 per cent of the weight of the charge treated. Approximately two-thirds of this mixture is charged with the cold metal, the remaining third being added after liquefication. The metal is somewhat overheated and the fused slag mixture is stirred into the melt (about 2 or 3 minutes) by means of a graphite rod. After removing the slag, the metal is treated with the requisite quantities of phosphor copper and left to stand quietly for a minute previous to pouring.

Reduction of the iron contents of brass alloys is usually carried out by the potassium sulfate process, although another method employing a potassium cyanide-soda-sand mixture has also been recommended. While the latter method offers the qualified advantage of being strictly reducing in nature its chief disadvantage may be considered the poisonous action of the vapor generated. It may therefore be employed where efficient hoods and a forceful upward draught can be maintained. The mixture consists of 65 to 75 per cent calcined soda, 25 to 15 per cent potassium cyanide and 10 to 5 per cent of powdered quartz, the potassium cyanide contents increasing with the amount of iron to be removed.

Rolled, Filled and Plated Gold

Q.—WHAT is meant by the words "rolled gold," "filled gold," and "gold plated"?

A.—The first two terms, "rolled gold" and "filled gold" are used interchangeably to describe goods that are made as follows: You begin by taking a flat bar or sheet of base metal (usually brass) and two thinner sheets of alloyed gold. Usually the gold is of 12-k or less, and generally the piece of base metal is ten to forty times as thick as the gold sheets. The three pieces of metal are then soldered together with the gold on the outside, like a sandwich, except that the "filling" is much thicker than the "bread." The "sandwich" is then rolled out very thin, the three pieces all being elongated in the same proportion, like one bar of metal, until it is thin enough to use in making up jewelry.

When chains are to be made, you begin with a cylinder of brass, which is fitted closely into a thin-walled tube of alloyed gold. The two are soldered together, then drawn down into wire of the proper diameter.

When you consider the way it is made, you can see why this stock is called rolled gold or filled gold. Note that the outer layer is not fine gold; it is a gold alloy. Sometimes you see a stamp saying "1/40 10-k" or the like. That means that one-fortieth of the metal is ten karat gold; the other thirty-nine-fortieths are base metal.

The term "gold plated" refers to articles that have been electroplated or gilded. The articles are made up of brass, and as the last step in the process of manufacture they are finished with an electro-deposit of gold. The gold layer is extremely thin, even thinner than in rolled gold. If you should carefully remove the gold layer and assay it, you might find it to be very high quality, but it is so thin that it does not represent much value.

You will note that when rolled or filled gold jewelry is made, the fastening on of the gold layer is one of the first steps in the process. Gold plating is the last step. Incidentally, much of the rolled gold jewelry, after being made up as described, is finally gold plated as well—the final film of gold being put on partly because of its attractive color, partly to cover any exposed edges of the base metal filling.

J. M.

British Institute of Metals Meeting

Abstracts of Papers Read at the Meeting in London, England, March 8-9, 1933. Subjects Discussed Included Low Melting Point Alloys, Tellurium, Magnesium, Copper, Aluminum, Zinc, and Nickel

EXPERIMENTS ON THE EFFECTS OF VARIATIONS IN MOULD AND POURING TEMPERATURES ON THE MACRO- AND MICROSTRUCTURES OF SOME LOW MELTING-POINT METALS AND ALLOYS

By Frances D. Weaver (Mrs. Harold Heywood)

Experiments are described on the effects of variations in mould and pouring temperatures on the macro- and microstructures of some low melting-point metals and alloys cast in a cast-iron mould.

Definitions of macro- and microstructure used by previous workers are criticized, and results, that are apparently contradictory, are correlated without the use of these terms.

Castings of a series of metals and alloys representing the different phases and combinations of phases found in various low melting-point metals and alloys have been prepared. These include common and pure tin, pure tin containing 2 per cent antimony, tin-lead eutectic and lead-base antimony-tin-lead alloys. The relative effects of variations in mould and pouring temperatures on the macro- and microstructures have been examined, and the results reviewed in terms of the constituents present.

The primary crystal structure, whether determining the macro- or the microstructure, is shown to be coarsened by raising either the mould or pouring temperature. Cored structures within the crystal grain, generally described as microstructure, are either coarsened or refined by increase in pouring temperature, according to whether the mould temperature is above or below some critical temperature not yet defined exactly.

Interesting crystal structure obtained with pure tin are described. Large crystals appear to be formed at two rates of cooling through the solidification temperature. Strain structures typical of those found in soft metals have been photographed.

SOME EFFECTS OF THE ADDITION OF TELLURIUM TO LEAD

By W. Singleton and Brinley Jones

Experiments on lead to which small amounts of tellurium have been added show that the resistance of the metal to concentrated sulphuric acid is remarkably increased. The physical properties of lead are also profoundly affected. The temperature of recrystallization is increased, and tensile tests carried out on rolled sheet show that tellurium-lead can be permanently work-hardened. The work-hardened can be regulated, so that rolled sheet with a wide range of physical properties can be produced.

It is shown that the material exists in the fully softened condition after normal extrusion, but that it can work-harden under strain. Tensile and freezing tests prove that tellurium-lead in the extruded state will undergo more distortion before fracture than any other metal examined, and it is shown that the character of the distortion is of great value in important practical applications. Fatigue tests on extruded sections indicate a range of $\pm$ 0.50 tons/in.^{2} on a basis of 10×10^6 reversals of stress without fracture.

Investigation has shown that the effects produced by the addition of tellurium to lead are also to some extent produced by its addition to various lead alloys.

INTERPRETATION OF THE TENSILE TEST (WITH REFERENCE TO LEAD ALLOYS)

By Professor Bernard P. Haigh and Brinley Jones

The modes of elongation of lead alloys in the tensile test vary widely. Photographs and stress-strain diagrams of several test-pieces are given, showing that test figures alone do not give an adequate idea of the character of a material. Elongation can be divided into "stable distributed strain" and "local strain." The separation of these types is considered theoretically, and the practical significance of each is discussed. Where severe plastic strains must be expected, stable distributed strain is invaluable for delaying fracture.

By means of "ductility diagrams" it is shown that ultimate stress is only indirectly related to fracture, and the conditions for a long range of stable distributed strain are deduced. Necking is discussed, and various types of fracture are mentioned.

The behavior of the various test-pieces is then discussed, and it is concluded that in comparing ductilities the different types of elongation should be considered. It is indicated that an alloy with a long range of stable distributed elongation should have advantages over ordinary lead in many important applications.

NOTE ON THE INFLUENCE OF VOLATILE CHLORIDES ON MAGNESIUM AND ON COPPER

By J. D. Grogan and T. H. Schofield

The soundness of magnesium is improved by melting the metal under a flux and treating with the vapor of certain volatile chlorides. Treatment with titanium tetrachloride does not produce an alloy molten at the usual casting temperature of magnesium alloys. The density of cathode copper is raised by melting under borax and treating with carbon tetrachloride, but not with titanium tetrachloride. The electrical conductivity of the treated copper is low, probably owing to the absorption of a small quantity of iron by the molten metal during treatment.

THE ELECTRICAL CONDUCTIVITY OF ALUMINUM WIRE

By A. J. Field and J. H. Dickin

The conductivity of hard-drawn wire is affected by heating and hot-rolling conditions and the characterstics of the rolling mill. Heat-treatment of the rod or finished wire increases the conductivity, the increase depending on the amount of work-hardness prior to treatment. The application of heat-treatment to actual production has been studied.

As with all metals, impurities affect the conductivity—iron less so than silicon.

THE FATIGUE-RESISTING PROPERTIES OF LIGHT ALUMINUM ALLOYS AT ELEVATED TEMPERATURES

By J. W. Cuthbertson

Examination of the fatigue-resisting properties of some aluminum alloys by a modified form of the rapid load-deflection test is shown to give results which, although usually somewhat too high, compare favorably with those of determinations made by the method of endurance, and are of particular value where a saving in time is essential and accuracy of a high order is not required. The importance of checking the work by periodical endurance tests is explained, and the results of a number of such tests are compared with those of the rapid tests, and the discrepancies discussed.

As the temperature of these materials is raised, the fatigue limit is shown to fall progressively, but still has quite a high value at 300° C. Above this temperature there is experimental evidence that the load-deflection test becomes unreliable and fails in its application.

The curves showing the effect of temperature on Young's modulus, under conditions of alternating stress, resemble the fatigue limit-temperature curves.

THE APPLICATION OF THE DIAMOND PYRAMID INDENTATION TEST TO COPPER AND COPPER-RICH ALLOYS IN THE FORM OF THIN STRIP

By Maurice Cook and Eustace C. Larke

A study has been made of the practicability of using, in the testing of thin metallic materials by the diamond pyramid indentation method, smaller loads than those now specified, and also of the degree to which the anvil effect influences the results when standard loads of 5 or 10 kg. are used. Tests have been carried out on copper, 70:30 brass, and phosphor-bronze in the form of cold-rolled strip, each material being tested at seven different thicknesses between the limits 0.040 and 0.0025 in., and in four different tempers ranging from fully-annealed to hard-rolled at each thickness, under loads of 0.5, 1, 2.5, 5, and 10 kg. It would seem, from the present practical study of the applicability of the test to commercial routine testing of thin materials, that the use of very small loads is neither necessary nor desirable, for the degree of accuracy and consistency obtainable decreases with decreasing load. As the load is decreased, the results are effected to an increasing extent by external factors, such as the surface condition of the material under test, and, moreover, with decreasing load the diagonal length units indicate larger ranges of hardness numerals. Using a hardened steel anvil it has been found that copper can be tested under 10 kg. down to 0.010 in. in thickness and under 5 kg. down to 0.005 in. for all ranges of temper, while brass and phosphor-bronze for all ranges of temper can be tested satisfactorily down to a thickness of 0.005 in. under a load of 10 kg. It has also been found that variations in the diamond pyramid hardness of the anvil, within the range of 140-700, have very little effect on the hardness results obtained, except on the materials 0.005 in. in thickness in the hard condition, which yielded low values when tested on the softest anvil used.

THE PHYSICAL PROPERTIES OF ZINC AT VARIOUS STAGES OF COLD-ROLLING

By R. Chadwick

The effect of progressive small rolling reductions on some of the physical properties of commercially pure electrolytic zinc strip has been studied. The amount of work-hardening obtainable by rolling was found to be quite small, and after reaching the maximum hardness further rolling produced a progressive softening. The changes in both physical properties and microstructure found to take place subsequent to rolling have been investigated over a period of 3 months. The nature of the changes depended on the amount of cold-work which the material had received. The effect of alloying constituents on the changes produced during cold-rolling was comparatively small, but the extent and rapidity of the changes occurring subsequent to rolling were profoundly influenced by small additions of alloying elements. The most notable features of the changes during, and after rolling were:

1. The improved physical properties produced by light cold-rolling were permanent, but the accompanying twinned structures failed to persist, and in many cases no twin bands could be observed within a few weeks of rolling.
2. Self-annealing of electrolytic zinc after heavy cold-rolling reductions. Softening was found to commence immediately after rolling, and to be complete in periods varying from a few hours to 1 month. The rate of self-annealing was modified by alloying.

The mechanism of cold-working is discussed, and a theory is advanced to account for the principal changes observed both during and subsequent to cold-rolling.

GRAPHITIC SILICON, HEAT-TREATMENT, AND THE ELECTRICAL CONDUCTIVITY OF ALUMINUM

By L. H. Callendar

Results by a new method show some effects of heat-treatment of the metal on the graphitic silicon figures obtained from sheet, wire, and cast aluminum. The first separation of graphitic silicon is shown to correspond in certain experiments with the beginning of a rise in the electrical conductivity of the metal. The method used for these experiments seems to give an indication of changes in the form of the silicon in the metal.

AN X-RAY INVESTIGATION OF THE COPPER-ALUMINUM ALLOYS

By A. J. Bradley and Phyllis Jones

The copper-aluminum system has been re-examined, using the X-ray powder method, with special attention to methods of heat-treatment. The authors, in agreement with earlier investigators, find that the body-centred β-phase cannot be retained by quenching; contrary to the experience of Obinata, they found that a homogeneous β' structure was invariably produced on quenching the powdered alloys. This structure appears to be closely related to the face-centred α-phase. Obinata's conclusion that alloys quenched from the γ range are indistinguishable from δ alloys has been confirmed.

The structure of δ-CuAl, up to 19 per cent aluminum, is essentially of the γ-brass type. The arrangement of copper and aluminum atoms was rigidly deduced from photometer measurements, and leads to the formula Cu_9Al_4. The modification of the δ-phase beyond 19 per cent, noted by Westgren, has been confirmed. In the δ' phase (19-22.5 per cent aluminum) the number of atoms in the pseudo-cubic cell falls from 52 to 49.

On quenching a two-phase alloy containing 22.8 per cent aluminum from 700° C., a single phase (ϵ) is obtained, which appears to be cubic. Between this composition and 29 per cent aluminum, the annealed and slowly-cooled alloy show many different types of structure. Stockdale's η-phase therefore consists either of a number of phases of small range, or modification takes place.

Friauf's structure for the θ-phase ($CuAl_2$) is confirmed by quantitative intensity measurements. As was found by Westgren, this phase has not a unique composition.

AN INVESTIGATION OF THE EFFECTS OF HYDROGEN AND OXYGEN ON THE UNSOUNDNESS OF COPPER-NICKEL ALLOYS

By N. P. Allen and A. C. Street

About ten alloys covering the range of the copper-nickel alloys have been investigated. On melting in hydrogen, all the alloys took up enough gas to render them very unsound on casting, the amount of unsoundness varying in a complex manner throughout the series. All the alloys melted in hydrogen could be largely degasified by passing nitrogen over the melt: this degasification was rapid, but was appreciably slower in alloys containing about equal proportions of copper and nickel. Alloys so degasified cast soundly provided that oxygen was absent. When oxygen was present, a second form of porosity appeared, provided that the oxygen exceeded a certain critical content. This "critical oxygen content" varied with the composition of the alloys, and was low for all alloys containing below 30 per cent nickel, and of the order of 0.02 per cent for alloys richer in nickel. The second form of porosity was due to the reaction of oxygen with hydrogen in the melt, and the "critical oxygen content" appeared to be connected with the solid solubility of oxygen in the alloy.

THE EQUILIBRIUM OF THE REACTION BETWEEN STEAM AND MOLTEN COPPER

By N. P. Allen

An experimental method is described for determining the equilibrium conditions in the reaction between steam and molten copper, and results are reported which have been obtained over a temperature range of 1090°-1350° C. and a water vapor-pressure range of 90-350 mm. of mercury. The behavior of the system is consistent with the ordinary mass-action laws, and the oxygen dissociation pressure of cuprous oxide has been calculated.

THE DISTRIBUTION OF POROSITY IN COPPER INGOTS

By N. P. Allen

The distribution of porosity in typical works' copper ingots has been studied by means of systematic density determinations throughout the ingot. Tough-pitch high-conductivity and arsenical-copper, cadmium-copper, and deoxidized copper ingots have been examined, and a study has been made of certain arsenical-copper ingots cast under pressure. The results show the existence of regular variations of density, the nature of which is discussed.

Embossing Dies and Presses

By W. B. FRANCIS

Associate Editor

Q.—CAN you tell me where the drop hammer and screw press properly come in, in making small embossed or formed pieces such as ash trays? Or probably I had better say what is the best use for a screw press?

A.—The screw press is for slow work, such as forcing hardened steel forms into soft steel blanks that are to be hardened and become the dies. This press is also used to produce a very heavy squeeze on malleable metals, such as aluminum, copper, gold, silver, etc., as required for making coins, medals, etc. Toggle, crank and cam presses are much more rapid and are more used than screw presses.

The drop hammer is extensively used for making drop forgings. In this process, highly heated metal is placed over the sunken form in a die which is set on the anvil of the machine, and the mating die, which is attached to the hammer head, is dropped one or more times from a considerable height onto the metal. The forging fills the form in the dies, with the excess metal attached as a thin fin around it. The fin is then trimmed off by the use of a special die and punch on a separate press. Drop forging is fairly rapid and the press is automatic in operation. This process is used for relatively thick parts formed from thick metal.

Thin sheet metals are stamped or embossed in dies of relatively large areas, such as the sheets for metal ceilings, etc. The sheets are not heated. The dies may be mounted in drop hammers using a strap or rope to lift the hammer head a short distance by a friction grip, when a hand lever is pulled by the operator.

For stamping and embossing operations on both large and small work in quantity with thin metals the toggle or crank press is most suitable because its operation is rapid and automatic, so that these articles can be produced at the lowest cost. Dies can be arranged on these presses to cut out the blanks for the article, and then to form and emboss them, all in one cycle of operations. The builders of these presses and the makers of the die sets are prepared to furnish outfits for the most economical production of all kinds of articles.

Metallic Calcium

Metallic calcium has been known since 1808, when Sir Humphry Davy made it in an impure state by reducing calcium oxide with metallic sodium. Ninety years later, Moissan produced the pure metal by the same process, but now it is manufactured quite readily by electrolyzing molten calcium chloride. It is harder than tin or lead, almost as hard as aluminum, and consequently has been used in light aluminum alloys, and in lead-barium-calcium alloys known as Frary metal, for anti-friction bearings. During the War, when there was a shortage of antimony, the metal became particularly useful. Lately a range of lead and calcium alloys which harden with age has been discovered, alloys which are especially adaptable as sheathing material for electric cable.

The principal uses for metallic calcium at present, center around its chemical and chemico-physical rather than its metallic properties. It is a powerful reducing and dehydrating agent and is an absorbent for gases. Calcium in very small amounts has been used to deoxidize copper, giving it increased ductility with more uniform grain size, while at the same time reducing the electrical conductivity to a much lesser extent than does zinc, beryllium, barium, strontium, or lithium.

The chief barrier in the way of the utilization of this metal has been, and still is, the cost of production. However, the price, which was about $20 per pound fifteen years ago, is now around $1.50, and if uses are found which increase the volume of production sufficiently, the cost may be brought in line with other more common metals.—"Industrial Bulletin" of Arthur D. Little, Inc.

Testing Materials Committee Meetings

Group Meetings of Committees and New York Regional Meeting

COMMITTEES of the American Society for Testing Materials held another in their series of annual spring group meetings in New York City at the Hotel New Yorker from March 6 to 10. This series of meetings, arranged for the convenience of committee members who are interested in the activities of more than one committee, was well attended despite the bank moratorium which made travel difficult. The financial crisis necessitated the cancellation of several meetings that had been contemplated and resulted in slim attendance at several of the meetings that were held, but in general very excellent meetings and very satisfactory attendance was the rule. That this was the case was due to the important work before these committees, and a considerable amount of committee work was accomplishing during the week, resulting in many recommendations to the Society on standards and tentative standards. About 400 registered.

Committee on Methods of Testing Approves Test Procedure for Metallic Materials

The **Sections on Tension Testing and on the Testing of Thin Sheet Metals** of **Committee E-1** on **Methods of Testing** held meetings on Thursday, March 9.

The tension section has been actively at work on the preparation of standardized methods of testing procedure for metallic materials. The tentative methods developed by the section, which were completely revised last year, have been well received and are considered to be suitable for advancement to standard in their present form.

The **Committee on Thin Sheet Metals** has standardized the test specimen and testing procedure for tension testing of sheet metals, which have been included in the complete tension methods. This section has also approved as standard its recommendations concerning those portions of the methods relating to sheet materials.

The **Section on Thin Sheet Metals** has been giving consideration to other tests which are made on sheet metals, such as drawing, bending, as well as the methods used in various laboratories in making these and other tests on metals in sheet form. The committee is now actively at work in correlating data on these and other methods for testing sheet metals. As soon as sufficient information and data have been collected on the various tests under consideration, standards concerning these tests will be developed.

Impact Testing Studied at Committee Meeting

At a meeting of the **Section on Impact Testing** of **Committee E-1** on **Methods of Testing,** held on Thursday, March 9, consideration was given to the standardizing of apparatus and testing procedure for impact testing of metals. A preliminary draft prepared by the **Chairman of the Impact Section, W. W. Wer-ring, Bell Telephone Laboratories,** served as the basis of discussion at the meeting. The proposed methods are based on information collected by the committee over the past eight years. These methods, which cover the simple beam method (Charpy type) and the cantiveler beam method (Izod type) define both types of testing apparatus, the methods of their calibration and include a proposed procedure for conducting the impact test. It was agreed to obtain further data concerning the details of the several types of apparatus and to prepare a further draft based on this information and the constructive suggestions resulting from the detailed review of the methods by the committee. It is also planned to study the proposed method when revised by a series of tests in the cooperating laboratories of the members.

An analysis of the replies received to a questionnaire on impact testing was also considered by the committee. Replies received from 43 concerns out of a total of 68 indicated almost unanimous agreement in urging standardization of test specimens for both the Charpy and Izod methods and the development of methods of impact testing. A demand for standardization of a round impact specimen and for a method of calibration was also shown.

Committee on Atmospheric Corrosion of Non-Ferrous Metals and Alloys Reports Results of One-Year Exposure Tests

The **Subcommittee on Atmospheric Corrosion** of **Committee B-3** on **Non-Ferrous Metals and Alloys** held a well attended meeting on March 8. The Committee considered an extension report presenting the results of the atmospheric corrosion tests on twenty-four non-ferrous metals and alloys after an exposure of approximately one year. The amount of corrosion was measured by: (1) determining the change in weight on duplicate 9 by 12-in. plate specimen; (2) tension tests to find the change in tensile strength and percentage elongation; and (3) making a visual examination of the 9 by 12-in. plates from each of the nine test locations to determine the amount and character of the corrosion products on the surface of the specimens. While no conclusions will be drawn by the committee at this stage of the corrosion test program, the results of losses in weight and changes in tensile strength and elongation after an exposure of approximately one year will allow interesting comparisons with similar properties of the original materials and provide data for future study by the committee.

The non-ferrous metals and alloys that are being studied in these corrosion tests include:

Commercial Copper (Tough Pitch)
Commercial Copper (Phosphorized)
Cu-Si-Mn Alloy
Tin Bronze
Aluminum Bronze
Commercial Aluminum
Al-Mn Alloy
Manganese Bronze
Brass (85-15)
Brass (70-30)
Admiralty Metal
Duralumin
Cu-Ni-Zn Alloy
Cu-Ni-Sn Alloy
Nickel-Copper Alloy
Commercial Nickel
Chemical Lead
Al-Mg-Si Alloy
Commercial Zinc (Prime Western)
Commercial Zinc (High Grade)
Lead Antimony Alloy
Commercial Tin
Aluminum-Coated Duralumin
Zinc (99.99 + per cent)

The atmospheric corrosion tests are under way at nine locations, representing as many types of atmospheric conditions.

The **Subcommittee on Corrosion in Liquids** reported on its work. The tests in sulfuric acid are partially completed and figures are being tabulated in the laboratories. Tests in hydrochloric acid, salt and caustic soda will be begun soon.

The **Subcommittee on Galvanic Corrosion** announced that the test couples, which have been exposed on the field test racks for a year were measured for loss in weight. This group is developing methods for removing corrosion products which is essential if accurate weight loss measurements are to be made.

Standards for High-Strength Silicon-Copper Alloys

Committee B-5 on Copper and Copper Alloys, Cast and Wrought, met on March 9. It was announced that the **Subcommittee on Wrought Metals and Alloys** will give consideration to the formulation of specifications covering high-strength silicon-copper alloys.

The committee approved revisions in the present standard specifications for brass pipe to cover Muntz metal, high brass, Admiralty metal and red brass for use in the fabrication of pipe suitable for use in plumbing boiler feed lines, etc. Favorable action was also taken to revise the standard specifications for copper plates for locomotive fireboxes, copper bars for locomotive staybolts, and copper and brass boiler tubing and pipe, to require a minimum copper content requirement of 99.90 per cent instead of 99.88 per cent as heretofore. The committee also approved for advancement to standard revisions in the Specifications for Sheet High Brass. The specifications as revised will cover two grades of sheet brass instead of one as formerly and two additional tempers have been added, three-quarter hard and extra spring.

In the Tentative Specifications for Copper Water Tube slight changes were made in the wall thicknesses of certain diameters. The three wall thicknesses of tubing covered by the specifications will now be designated as classes K, L and M instead of Classes A, B and C as heretofore. These specifications which cover seamless copper tubes especially designed for plumbing purposes, underground water purposes, copper coil water heaters, fuel oil lines, gas lines, etc., have been approved for advancement to standard, and this recommendation will be presented to the A.S.T.M. at the annual meeting of the Society in June at Chicago.

Standard Grain Size Chart Approved

Announcement was made to **Committee E-4 on Metallography,** at its meeting on March 8, that the proposed **Tentative Standard Grain Size Chart for Classification of Steels** had been approved for publication by the Society's **Committee on Standards.**

A subgroup, under the chairmanship of **E. H. Dix, Jr., Chief Metallurgist, Aluminum Company of America,** has made much progress in combining into a single method of metallographic testing the present standard methods covering iron and steel and nonferrous metals. When this group finishes its work, it is expected that the single method will cover the general procedure common to both ferrous and nonferrous metals and alloys and provide for separate sections on special methods for different types of alloys.

Choosing Aluminum Fluxes

By JAMES BRINN

Metallurgist

THE average foundryman probably does not know that fluxing aluminum with zinc chloride introduces a small quantity of zinc into his aluminum. As a rule this small addition of zinc does not harm the metal, but there are certain alloys, for which the specifications limit the zinc content to such a small percentage, that fluxing with zinc chloride should not be resorted to. One example is the 95% aluminum 5% silicon alloy for which one specification allows only ¼ of one per cent of zinc.

The following interesting experiment shows the chemical reaction between aluminum and zinc chloride. Take a piece of aluminum sheet and place a quantity of zinc chloride on it. Hold it over a Bunsen flame and observe that the salt melts and bubbles, due to the escape of moisture. After a while the bubbling ceases and white fumes appear. These are formed as a result of the chemical reaction which takes place between the aluminum and the zinc chloride. If the aluminum sheet now is quenched in water and the excess zinc chloride washed off, spots of metallic zinc will appear on the aluminum. The zinc can be identified as such because of its color and because of its reaction to nitric acid. A few drops of nitric acid placed on the sheet will not attack the aluminum but will attack the zinc under formation of gas bubbles.

If zinc chloride cannot be employed as a flux, cryolite or mixtures containing cryolite should be used. The cleansing effect of zinc chloride, i. e. its power to free the metal from dross and foreign inclusions and bring these to the surface where they can be skimmed off, is very great. Therefore when melting dirty and oily material such as crankcases, borings, etc., fluxing with zinc chloride is to be preferred, and it will be found that the dross in such case is more free from metal than if other fluxes are used. This is of course important, since all metal that is contained in the dross is an actual loss.

The disadvantages of zinc chloride are the following: It introduces zinc into the metal, which in a few cases is prohibitive. It rapidly absorbs moisture from the atmosphere and must therefore be added cautiously to the aluminum. A large amount of gas and smoke is formed upon fluxing, which is of course an undesirable feature.

In melting comparative clean material, such as aluminum sheet, aluminum clippings and scrapped castings, etc., it is of advantage to use cryolite or cryolite containing mixtures. These have the following advantages: they do not introduce zinc into the aluminum; they are dry and can be kept in open containers; they generate much less smoke and fume than zinc chloride. They are however not as effective as zinc chloride in cleansing dirty aluminum.

Peeling of Electrodeposited Nickel

By Dr. E. A. VUEILLENMIER
Dickinson College, Carlisle, Pa.

How a Device to Measure the Contraction of Nickel Deposits Helps. The Need for a Device to Measure Adhesion

FROM THE REVIEW OF THE AMERICAN ELECTROPLATERS' SOCIETY, JANUARY, 1933.

WAY back in 1916, over at the University of Berne, Switzerland, we were attempting to do something that we didn't succeed in doing, something that remained for Dr. Blum and Dr. Roden to do at the Bureau of Standards. We were making a systematic study of the nature of the deposit that is obtained from various metals. We make a lot of observations, but we weren't able to do what Dr. Blum was able to do, to classify the observations. The time had come for us to plate out from nickel, and strange as it may seem to you, we had no nickel to use as a nickel anode. I rather think that any nickel that was in Switzerland at that time was being used for other purposes. We weren't able to get hold of any metallic nickel, but we had some nickel solution, so the obvious thing, of course, was to prepare a nickel anode from the nickel solution by plating out, using a platinum anode and a platinum cathode. The platinum anode was a thin sheet, and the next morning I noticed that this thin sheet of platinum was bent. It occurred to me, of course, that in putting the metal into the bath, I might have bent the metal accidentally, but fortunately I repeated the experiment, being careful to note that the piece of platinum was perfectly straight, and the next morning it was bent. The next step in this study, was to attach a pointer to the bottom of the platinum cathode, a long, thin glass pointer, and then we were ready for business. We used our home-made nickel anode, and this (showing small strip of metal) was our cathode, and turned on the current, and the thing happened that we expected to happen. The pointer moved. Immediately, as soon as we turned the current on, the pointer moved. There was a scale up here, and we could study the speed with which the pointer moved. As soon as the current was turned on, the pointer moved toward the right, and we found that the speed with which the pointer moved depended, of course, upon a variety of conditions. After we had plated out for twenty or thirty minutes, or for an hour or two, we reversed the current, and much to our satisfaction, the pointer moved in the opposite direction, proving of course, that the platinum foil had not been permanently deformed.

Now, of course, in those days nothing was known, or very little was known about pH, and the solutions that were used were rather haphazard, and there were all sorts of explanations for the peeling of nickel plating. The peeling of nickel plating was blamed by many people on hydrogen. So we thought we would find out what hydrogen would do to the "Contractometer"* that had some nickel plated on it. So instead of using a solution of nickel sulphate, we used an electrolyte of dilute sulphuric acid, or dilute sodium sulphate. We had the platinum anode, and here the platinum cathode that had some nickel plated on it, and the cathode, of course, had been bent. We turned on the current, and of course the thing that we expected was that since hydrogen was responsible for contraction, for peeling, we expected that hydrogen would make the pointer keep on going in the same direction that it had been going. But, much to our surprise, it did exactly the opposite. In other words, when you plated out hydrogen into this nickel, what happened? The pointer moved to the left instead of the right.

Then, of course, the question of iron in nickel plating baths. A number of years ago, Mr. Thompson down at the Bureau of Standards, made a very careful study of the effect of iron in nickel plating solutions. In those earlier days, of course, nickel anodes contained 6%, 8%, 10% of iron, and there were some people who worried very much about the presence of iron in nickel plating solutions. Certain of the German investigators claimed that the reason why you had peeling was because of the iron. Mr. Thompson, down at the Bureau of Standards, carried out a very interesting series of experiments in which he added a definite amount of iron to his nickel plating solution and then he investigated the deposit; that is, he studied the deposit, and found out whether the nickel would peel. And the conclusion to which he came, (and he presented his results in New York some five or six years ago at a meeting of the American Electrochemical Society)—the conclusion to which he came, if I understood them correctly, were that the presence of iron need not necessarily cause peeling. We rather got the impression from what he said that iron in nickel plating solutions is not objectionable.

At that time, we had a contractometer set up at Carlisle, at Dickinson College, and we immediately proceeded to study the same solutions that Mr. Thompson was using. We studied them with the help of this little instrument. And we had reached the point, of course, where we knew a little something about pH. The earlier investigations had ignored the matter of pH entirely. We prepared a solution of nickel sulphate that was normal in nickel, and quarter molar, if I remember correctly, in boric acid, and adjusted the pH by means of sulphuric acid, dilute sulphuric acid. We prepared a solution that had a pH of 5.7, and with that particular instrument, in twenty minutes the pointer moved 5 m.m. We prepared a similar solution having a pH of 6.1, and in twenty minutes the pointer moved 4 m.m. Then we took the solution that had a pH of 6.1 and added a little bit of ferrous sulphate to it—sufficient ferrous sulphate so that the solution con-

*See METAL INDUSTRY for October, 1921, page 419, and March, 1922, pages 109-10.

tained one gram of iron per liter, and we tested it out with the contractometer. This solution was made by adding the ferrous sulphate to the solution having a pH of 6.1, and the pH dropped to 5.9. That is, the pH of these three solutions was practically the same, 5.7 to 6.1. We tested this solution containing the iron with the contractometer, and the pointer instead of moving four or five m.m. in twenty minutes, it just raced. It moved 26 m.m. That is, with the pure nickel solutions, you could barely see the pointer move, but when this little bit of iron, one gram per liter, was present, the pointer raced 26 m.m. in twenty minutes.

Now, this is the conclusion to which we came. First of all, a word about other methods. We studied silver from the cyanide bath, and when you plate silver from the cyanide bath, the pointer likewise moves, that is, there is a slight tendency toward contraction. If you use a copper solution, cyanide copper for instance, or tartrate, the pointer moves, but very, very slowly. Ordinarily, when you plate from a nickel solution, the pointer moves fairly rapidly at first, and moves more and more slowly. Now, you might draw the conclusion that as you plate out nickel, you get a thicker and thicker cathode, and that that is what is responsible for the slowing up of the pointer. That is, in the first five minutes it will move so far, but after it has been running say from fifteen to twenty minutes, in that five minute period of course it moves less. Now you might easily get the impression that that is due to the fact that you have on top of your platinum (and by the way, the side away from the anode was coated with vasoline or some other insulating material)—you might get the impression that that slowing up of the pointer was due to the fact that you are now having to bend, in addition to the platinum, some nickel, and of course, that is true to a certain extent. But we found, for instance, that when we used an iron solution, that the pointer would move quite rapidly, but instead of slowing up, it would go faster and faster. We found that when we plated from a solution of copper sulphate containing sulphuric acid, that the pointer would move rather rapidly at first, but after perhaps two or three minutes would practically come to a standstill. Now, you know that when you plate copper from sulphuric acid solution of copper sulphate, that your deposit at first is dense and smooth and shiny, but gradually it becomes coarser and coarser, and as soon as you get a coarse deposit here the contraction seems to cease.

Summarizing, then, this is our notion on the subject of the peeling of nickel plating. When you plate nickel from a solution, the nickel film that is plated out has a tendency to contract. Of course, if you are plating out on something thick, that tendency to contract will still be there, but if this material is thick, is rigid, as of course it would be if it is thick, it won't obligingly bend as this thin sheet of platinum bent, and the result will be that the nickel will peel. The extent to which this tendency is present will, of course, depend upon the nature of the solution. We believe, that it is very materially influenced by the presence of iron. Now, it is true, of course, that Mr. Thompson did not get peeling in the presence of iron. He was unable to get the solution to cause a deposit that would peel. But where you have a thick piece of metal, you are plating nickel on it, you are using a pure nickel solution, there is a very slight tendency toward contraction. On the other hand, if your solution contains iron, there is a tendency toward contraction that is five times as great. Now, of course, if your nickel adheres, then of course there won't be any peeling. That, apparently, is the trick. If you can get adhesion, then you needn't worry so much about peeling. But the tendency for the metal to contract is there, in the presence of iron. We believe, that if your nickel is shiny, that that kind of nickel will have a tendency to peel. That is based upon not our wide experience as electro-platers, but based upon our studies with this little instrument; that if you want metal that does not tend to peel, the metal must be relatively coarse and not shiny. We believe, that you want to keep away from iron, and we believe, of course, that the surface to be plated must be perfectly clean.

On a number of occasions, I have mentioned this later point (a perfectly obvious one, of course). We have here an instrument with the help of which we can measure the tendency to contract. The next thing that we need is an instrument that will measure the degree of adhesion.

Properties of White-Metal Bearing Alloys

THE usual white-metal bearing alloys require tin or antimony, or both, as essential constituents. Both tin and antimony are so-called "strategic" metals and the potential military demands for them are considerable. These facts were responsible for the sponsoring by the War Department of recent studies at the bureau aimed toward the reduction or possible elimination of the amounts of tin and antimony needed for bearings.

One phase of this work was a study of the wear resistance and other mechanical properties of 11 white-metal bearing alloys. The alloys tested included 2 tin-base and 8 lead-base alloys, and 1 alloy of cadmium and zinc.

Each of the properties, with the exception of wear, was determined at several temperatures ranging from 20° to 200° C. (68° to 390° F.), since it is in reality the properties at the higher temperatures that play the major part in determining the success or failure of a bearing metal under service conditions. Resistance to wear was determined only at 20° C. No one of the alloys considered was found to excel in all of the mechanical properties studied. Thus, the tin-base alloys showed higher resistance to wear and in most cases had higher Izod impact values at each temperature of test than did the lead-base alloys. In most cases, however, the tin-base alloys showed lower resistance to pounding than the lead-base and cadmium-zinc alloys. The hardness numbers and compressive properties of the tin-base alloys were found to be lower than those for the cadmium-zinc alloy and the lead alloys hardened (1) by additions of calcium and barium and (2) by additions of calcium, sodium, potassium, and lithium. The mechanical properties of the lead-antimony-tin alloys, in most cases, were higher as the tin content was increased.

Crank-shaft bearings of four compositions were prepared for service tests in U. S. Army class B trucks. These compositions consisted of two tin-base and two lead-base alloys. The results of these tests indicated that the tin-base alloys were superior in their wear resistance to the lead-base alloys. These results were consistent with those obtained on wear in the laboratory tests.

A complete report of this investigation was published as Research Paper No. 512 in the Bureau of Standards Journal of Research for January, 1933.

Notes on the Efficiency of Rhodium Plating Baths

By V. L. BIGSBY

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The Plating Efficiency of Any Bath Affects the Durability of the Deposit, and, Consequently, the Relative Plating Efficiencies of the Various Types of Baths Should Be Determined Instead of Relying on Color Comparison Alone.

THE use of rhodium as a brilliant and protective finish for jewelry, novelty metal ware, silverware, scientific instruments, optical goods and a variety of other products is a comparatively recent electro-plating development.

For this reason baths of various types with greatly varying characteristics have been made and discarded and replaced by new ones, plating conditions and procedures have been studied and altered to meet the limitations or capabilities of rhodium baths, steady technical investigation has been employed, all to the end of obtaining a solution which, with optimum conditions, will give the brightest plate. Brilliance of plate, however, does not imply the greatest resistance to wear.

Durability of the rhodium plate is quite as desirable, often more important than brilliance. Corrosion and abrasion are conditions that have to be seriously considered in determining whether rhodium plating will be satisfactory.

The sole object of increasing the plating efficiency of a bath is to obtain the maximum durability of a given weight of deposit. The higher the efficiency of the rhodium plate, the greater the tendency of the plate to be dense and hard which, in turn, reduces the degree of porosity. This has been definitely determined by salt spray and abrasion tests.

Plating efficiency is the ratio of actual deposit to theoretical deposit.

High efficiency of rhodium plating interpreted, practically, means that the electrical energy is depositing rhodium instead of liberating hydrogen gas from the bath.

Low efficiency means less rhodium deposited and more gas evolved. The result of low efficiency in rhodium plating is the excessive liberation of hydrogen gas which adversely affects the porosity of the plate.

Plating time in many cases can be materially reduced by increasing plating efficiency. A high efficiency rhodium plating solution, therefore, will either lower the plating time or the current consumption and increase the wearing quality of the plate, the weight of rhodium deposited from the high efficiency bath being equal to the rhodium deposit from a low efficiency bath.

There are limitations to the maximum plating efficiency obtainable. Some of these limitations are: type of bath, temperature, current control and rhodium concentration. Burnt or smoky deposits set practical limitations to the maximum efficiency of the bath, for without brilliant color, rhodium deposits are valueless from the sales standpoint. A rhodium plating bath which can expand these limits will increase the plating efficiency with no loss of color in the resulting deposit.

The plating solution is the most important consideration. A good bath will increase the range of conditions which make higher efficiencies possible. Since in our own laboratory we found a rhodium sulphate solution to be the most satisfactory, the rhodium sulphate bath will be the type considered in the following discussion of the ideal conditions for obtaining the highest plating efficiency of rhodium.

The temperature of the rhodium plating bath has a great effect upon the plating efficiency. Increasing the temperature of the bath will lower the bath resistance which, in turn, gives higher efficiency. Higher bath temperatures also lessen the tendency of gas bubbles to cling to the cathode. Should gas bubbles cling too long to the cathode, spotty deposits may result. The maximum temperature is determined by dull plating, the excessive softening of lacquer, and too rapid evaporation of the bath.

There are certain types of baths wherein a high bath temperature results in a smoky or burnt deposit. A rhodium sulphate bath permits higher temperatures to be used safely. The use of lacquer on objects to be plated will of necessity limit plating temperatures. If the bath is too hot this lacquer will strip off. Therefore, the advantageous effect of higher bath temperature must be sacrificed sometimes for this reason. Too hot a plating bath will necessitate frequent replenishing with distilled water to make up evaporation loss.

The current density (frequently expressed in amperes per square foot) used in rhodium plating has a very noticeable effect on the plating efficiency. The lower the current density, the greater the plating efficiency. The labor time factor places the limit permissible on the efficiency in economical plating. When only a very thin deposit is required, labor is an important consideration and often a higher current density with a lower efficiency is more desirable than increasing the labor time by using a low current density and obtaining a less porous plate. The higher current density will deposit the rhodium more rapidly but the weight of this deposit is limited, since a smoky rhodium deposit will very quickly be the result. The lower current density will not only improve the density of the deposit but also noticeably increases the amount of rhodium which may be deposited without producing a smoky or burnt deposit.

The rhodium concentration of the plating bath is also a factor in obtaining high plating efficiency from a sulphate

bath. The best current density conditions are those kept inversely proportional to the rhodium concentration, that is, the lower the concentration the more voltage and current density are required to give the desired color to the deposit. This holds true until a concentration of four grams of rhodium per liter is reached. Greater concentrations of rhodium show no advantage in plating efficiency, consequently, higher concentrations have not been normally used.

Since the plating efficiency is governed by the current density which, in turn, is affected by the rhodium content, we may say that the metal concentration affects the plating efficiency. It is also interesting to note that when all other conditions are the same and the metal concentration is the variable, the efficiency of the bath is governed by the rhodium content. The maximum plating efficiency is obtainable at a three and one-half gram rhodium concentration. Above the optimum concentration the efficiency declines gradually, below the three and one-half gram concentration the efficiency drops rapidly.

Some other factors which also tend to control the plating efficiency and the color of the deposit are: the distance from the anode to cathode, the ratio of anode to cathode size, the acid concentration, and the use of proper addition agents. All of these factors have been determined experimentally and their influence found. If these factors are ignored the resulting deposit will often be dark and, hence, unsatisfactory.

A knowledge of the plating efficiency of a bath under the plating conditions to be used is exceedingly helpful. Plating efficiency equals the actual weight of deposit divided by the theoretical weight of deposit. The actual deposit is found by weighing quantitatively in grams. The theoretical deposit is—amperes x minutes x .0213 grams rhodium—.0213 is a constant theoretical weight of deposit for trivalent rhodium for 1 ampere-minute. A close approximation of the rhodium to be deposited can be made by knowing the plating efficiency, the amperage used, and the plating time.

The weight of rhodium deposited in grams may be estimated by multiplying the theoretical deposit by the efficiency.

Since at times it is necessary to predetermine the cost of rhodium plating, the foregoing formula will give accurate data to make reasonably reliable estimates. The actual weight of rhodium as determined by quantitative weighing will be necessary to make accurate cost analyses. The weight of rhodium deposited on articles of uniform size will remain constant if the plating conditions are kept constant.

In recapitulation, therefore, we find that high plating efficiency is desirable for the purpose of increasing the density of the rhodium plate and minimizing the porosity. From the sales standpoint, the color of rhodium plate is its most desired feature. Color, plus a high efficiency plate gives a finish that is many times more durable and corrosion resistant than a rhodium plate that has the desired color characteristic alone.

Nickel on Die Castings

Q.—I am interested in plating die castings of a zinc base and would like to get your suggestion on what kind of a nickel solution to use and what percentage of hydrofluoric dip you would use.

A.—The following formula for a nickel solution to plate zinc die cast work is recommended:

Sodium chloride	7 ozs.
Boric acid	2 ozs.
Sodium citrate	1 oz.
Double Nickel salts	10 ozs.
Water	1 gallon

Operate the solution at 80° F. and a pH of 6 to 6.2. The work after the cutting down operation, if very greasy, should be washed in gasoline, dried in sawdust, and then colored, using as little lime composition as possible.

Use a mild alkaline cleaning solution either as a still or electric cleaner, rinse in clean cold water, and then place the work in a 1% hydroflouric acid dip until a very slight evolution of gas is seen. Rinse work in clean cold water, and place in the nickel solution. The current should be on when the work is placed in the nickel solution, and use a high current of 4 or 5 volts to strike the work for a few seconds, then reduce to 2½ to 3 volts for five to ten minutes. A five to ten minute deposit is sufficient.—O. J. S.

Blue on Guns

Q.—Can you send me a good economical procedure for re-finishing pistols and guns in blue steel finish?

A.—A blue finish can be produced on steel by using a molten sodium nitrate bath. Place a quantity of sodium nitrate in an iron pot and heat to 700° F. The work should be clean and dry before placing in the sodium nitrate bath. Let the work remain in the nitrate bath for 1 to 2 minutes or until the blue color is produced. When the work is taken from the bath, it is left to cool and dried through the use of hot water, and sawdust. Oiling this finish with paraffine oil helps to preserve the finish.—O. J. S.

Report on Plating Research

A Progress Report has been issued on the research into the protective value of electroplated metal coatings on steel by the Joint Inspection Committee of the American Electroplaters' Society, American Society for Testing Materials, and Bureau of Standards. This report is similar to that published in the Review of the American Electroplaters' Society, January, 1933, and METAL INDUSTRY for February, 1933, and was modified to include results to March 1, 1933.

The results confirmed the previous conclusions. In addition, it was found that vapor cleaning worked satisfactorily.

In the work on accelerated tests, the results obtained with the ferroxyl tests were approximately parallel to those of the exposure tests. The salt spray test is being applied at a constant temperature, and as 35° C. (95° F).

Correction

It was stated in our last issue that Ferro Enamel Corporation had developed a porcelain enameled coating for metal blackboards. This announcement came from the Ferro Company, and they now wish to state that the exclusive sale of Porcelain Enameled Metal Blackboard is in the hands of American Seating Company, Grand Rapids, Mich.—Ed.

Platinum in 1932

By CHARLES ENGELHARD

President, Baker & Company, Ltd., Newark, N. J.

CHARLES ENGELHARD

THE platinum metals generally felt the lack of stimulation in the industry during the year 1932, but for certain uses and particularly in the jewelry trade platinum improved its position despite market conditions.

With the lower prices for platinum and a desire on the part of retail jewelers to carry better quality merchandise, certain platinum articles actually had a wider distribution and sale. This was particularly true of wedding rings.

Manufacturers of ring blanks made greater efforts to merchandise platinum rings and settings for the remounting of old jewelry, and they found among retail jewelers a pleasingly responsive attitude. Better demand for articles for men, such as platinum collar pins, cuff links, pencils and knives, also was reported by retail jewelers.

The production of two trophies of platinum for the Culbertson World Bridge Olympic stimulated interest in platinum articles of this type. Of equal importance was the realization by the jewelry trade that iridium-platinum could be drawn and spun with relative ease, and that its flat surface had a distinctive and interesting appearance which made it desirable for other large articles for the home. Dresser sets and after-dinner coffee services are possibilities. Two George Washington Bicentennial medals, which were presented to President Hoover and the Library of Congress, were struck in platinum, marking the first time in its history that the U. S. Mint struck medals from platinum.

Radically new types of plating baths for the deposition of platinum and palladium were developed, and the already highly successful rhodium baths were further improved. Electrodeposits of palladium as thick as .020 inches were produced.

The role of platinum metals in dental alloys was further studied, and the results were communicated to the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineering. In this work the important improvements resulting from the replacement of considerable percentages of gold by platinum or palladium were demonstrated. Recognition that the high palladium content dental alloys, which are white in color, are less conspicuous than gold in the mouth, led to the development and marketing of such alloys by several of the leading dental manufacturers.

There has long been a demand for electric resistance furnaces which could be used in the temperature range from 1100 degrees C to 1300 degrees C. At its present price, platinum can be economically used as the resistor in such furnaces, and during 1932 there was considerable interest shown in the development of long-life platinum-wound furnaces, in the form of small laboratory and dental equipment as well as of commercial furnaces of rather large size.

Platinum as a catalyst in the production of sulfuric acid was given more attention during the year, following the presentation last year of a paper on "Which Sulfuric Acid Catalyst—Platinum or Vanadium?" before the American Institute of Chemical Engineers. With its efficiency and low market price, platinum as a catalyst aroused renewed interest in the industry, which is bound to have results.

Small quantities of platinum-clad nickel and palladium-clad molybdenum were produced for special purposes, while tests of corrosion-resisting alloys containing platinum were begun in chemical plant equipment in which the usual corrosion-resisting base metals proved to be inadequate.

Rhodium in 1932

Rhodium was increasingly used in 1932 where a white, highly reflective, non-tarnishing electroplate was required. For some years rhodium plate found its principal use as a finish for white gold or silver jewelry, but in 1932 the higher reflectivity of this metal as compared with other metals led to its use for finishing the 60-inch reflectors employed in the U. S. Army searchlights, and to some 3,000 smaller reflectors used in the lighting of the stage of the new Music Hall at Rockefeller Center, New York.

—CHARLES ENGELHARD.

Mercury on Copper

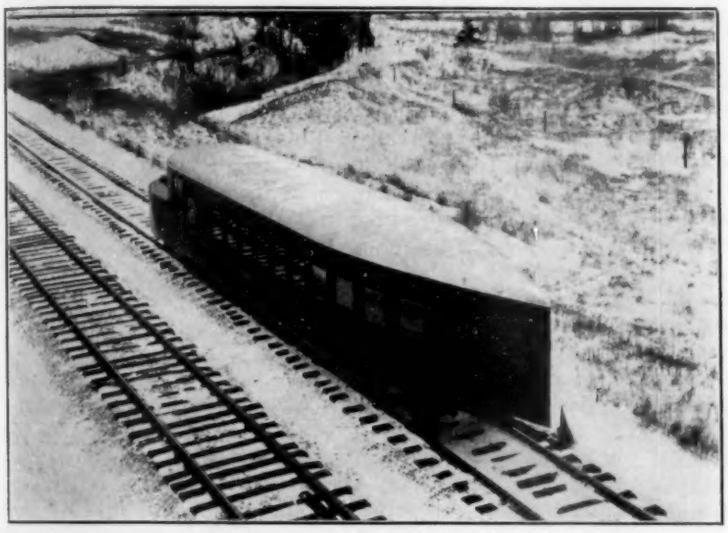
Q.—May we have what information you have on how to deposit mercury on copper or brass or in form of a amalgam. Can it be done by electrolysis and would the surface be durable?

A.—If copper or brass is immersed in a solution of a salt of mercury, e.g., a nitrate, it will be coated with mercury which in a short time will amalgamate with the metal and form an amalgam. The coating of mercury will not be durable. It will be absorbed by the brass or copper or evaporate into the air if heated. It cannot be made permanent. If the copper or brass has been cold worked there is every probability that "season cracks" will develop and split the metal.

Mercury and gold can be made into an amalgam and applied to brass in a stoneware rolling barrel. The article is then heated to drive off the mercury and leaves the gold on the brass. This is called fire gilding.—G. B. H.

Light Alloys Help Make Possible the Autotram, Latest Development in Railway Cars

DEVELOPMENT of the Autotram by the Clark Equipment Company, Battle Creek, Mich., is another step in the progress of aluminum alloys in the transportation field. The Autotram is a streamlined car combining features of automotive as well as railway design. It has a body made almost completely of light alloys; steel trucks; and wheels of composite aluminum, rubber and steel construction. The car is equipped with fittings and accessories made chiefly of aluminum, while no direct comparison is possible, as no similar car of other materials has ever been built, it is conservatively estimated that the Autotram is 18,000 pounds lighter than it would have been if aluminum construction had not been employed. This saving in weight is directly reflected in lower operating and maintenance costs.



The Autotram During a Run on the Michigan Central Railroad

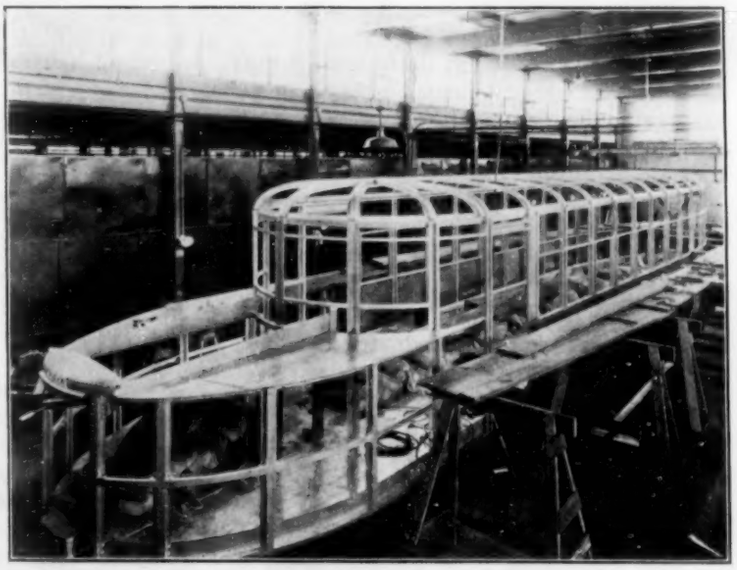
The Autotram is designed for main line use by railroads. The combination of railway and automotive design, with full streamlining and a 16-cylinder V-type gasoline engine, makes it possible to operate the car at a speed of 70 miles per hour. Running as a single unit, the car is expected to expand the facilities of the railroads, which are giving the Autotram trials with a view to making use of it. It carries 42 persons, and is equipped with full air conditioning and other modern features. The wheels, for example, are designed to permit the use of rubber tires when such tires are perfected for rail service.

The Autotram shown in the illustrations is the first full size model built, and is arranged inside as a lounge, it is very luxurious, having aluminum chairs and tables, and other furniture, a very complete lavatory, double windows of shatter-proof glass, and numerous other devices for safety and convenience. For regular service the seating of the Autotram would be arranged somewhat like a standard rail coach, for 42 people.

The use of strong aluminum alloys wherever possible was dictated by a desire to decrease the weight of the car without losing any of the strength necessary in a car intended for heavy, main line duty. The Clark company credits the Development Division of the Aluminum Company of America, Pittsburgh, Pa., with a considerable part of the success of the venture. They also state that the mills of the Aluminum Company gave excellent collaboration in production of the light alloy parts.

Alcoa structural plates and shapes such as bars, rods, channels, tubing, extruded forms and castings went into the construction. All material was chosen for ease of fabrication, and a minimum of shop forming was required in building the body. All forming was accomplished without use of heat, and only simple metal-working tools were used. Hot-driven steel rivets were used in heavy assembly work, and self-tapping steel screws for attaching interior side sheets, ceiling, partitions and trim molding.

A number of concerns besides the Aluminum Company contributed to the development. They include the Cadillac Motor Car Company, Detroit; B. F. Goodrich Rubber Company, Akron; Harrison Radiator Company, Lockport, N. Y.; Hydraulic Brake Company (division of Bendix), Detroit; Kohler Company, Kohler, Wis.; Minneapolis Honeywell Regulator Company, Minneapolis; Union Switch and Signal Company, Swissvale, Pa. Some other companies made parts and fittings.



The Autotram's Superstructure of Aluminum Alloy Sections

EDITORIALS

A Momentous Decision

A decision was recently handed down by the United States Supreme Court which may be far-reaching in its effect upon American industries of all types. It had to do with the operation of a co-operative selling agency of coal producers, called Appalachian Coals, Inc. This corporation, owned by 137 coal producers in Virginia, West Virginia, Kentucky and Tennessee, agreed to establish standard classifications, to sell all the product of its principals at the best prices obtainable and if all of it could not be sold, to apportion orders upon a stated basis. Prices were to be fixed by officers at the central office with certain exceptions and special protective arrangements.

The decision of the Supreme Court stated that the general phrases of the Sherman Anti-Trust law, interpreted to attain its fundamental object, set up the essential standard of reasonableness. It was shown that the law aims at substance; that the question involved was whether there was an unreasonable restraint of trade or an attempt to monopolize; that the mere fact that the parties to an agreement sought to eliminate competition between themselves was not enough to condemn it, since no attempt was made to limit production. Appalachian Coals, Inc., controls about 73 per cent of the total mining capacity in its district and the operators making up the organization will continue to be subject to active competition from the other 27 per cent.

The importance of this decision to industry in general lies in the fact that it is applicable to all industries; that common selling agencies can be set up elsewhere, and that if they operate under the standard of reasonableness, they are not illegal combinations in restraint of trade.

It is true that this decision will serve only as a precedent, and that each case in the future will be an individual problem. Nevertheless, the precedent has been established and its effect may be of extraordinary benefit to business.

New Alloys from the Old Metals

Almost daily we see proof of the limitless field for new alloys. It is a fact that we have less than a dozen common non-ferrous metals, but these, combined in varying percentages and in binary, ternary and quarternary alloys allow for thousands of possible mixtures. In addition we have the possibility of adding small amounts of the rarer metals, which increases our working area in geometric proportion.

One of the latest accomplishments is the improvement effected in lead by the addition of tellurium, as described in a paper by Singleton and Jones read at a recent meeting of the British Institute of Metals (see abstract on page 125 of this issue). It seems that small amounts of tellurium increase the resistance of lead to sulphuric acid. The physical properties of lead are also favorably affected. Work-hardening can be regulated and made permanent so that rolled sheet with a wide range of physical properties can be produced. It seems also that the effect of the addition of tellurium to various alloys is often similar to that caused by its addition to pure lead.

It seems possible that this development may disclose new avenues of usefulness for lead.

The History of Electroplating

No one engaged in an art or industry should become so immersed in his daily work as to lack interest in the broader aspects of his art. It is well to take our noses from the grindstone occasionally. For that reason, among others, an article recently published in Chemical and Metallurgical Engineering by Dr. C. L. Mantell, whose name has appeared a number of times in our columns, is of considerably more than passing interest.

In tracing the March of Electrochemistry, Dr. Mantell, of course, included electroplating. Electroplating undoubtedly had its inception in the discovery by Faraday of the laws of the action of electrical energy on chemical substances and solutions in 1834. The chemical battery or gravity cell, invented by Daniell in 1836, made it possible, by providing a more powerful source of electrical energy, for the Elkingtons in England, to develop actual electroplating in 1836. Jacobi in 1839 worked out a process of electrotyping. In 1840 Wright succeeded with cyanide plating solutions. Russell and Woolrich in 1849 were the first to deposit cadmium electrolytically, but their discovery had no commercial value until 70 years later when sufficient quantities of the metal became available. Copper refining came in about 1860, also from the Elkingtons.

The broad commercial application of nickel plating was made possible by Adams in 1869 and had its first impetus through the use of nickel plated handle bars for bicycles. Shortly afterward, in 1874, a low voltage plating generator was developed by Weston. This was followed very shortly by commercial copper and silver refining in the United States by Balbach and Thum.

The plating industry then took a breath and abstained from new developments, utilizing the interim in strength-

ening itself commercially. Between 1900 and 1905, however, the electrochemical theory of corrosion was laid down by Whitney. Betts refined lead and Burgess, iron, from electrolytic solutions. Hybinette in 1906 perfected a practical method of producing electrolytic nickel. The "electrowinning" process spread to zinc and cadmium after having been applied to copper in about 1910. Cobalt plating appeared about 1915. Cadmium was plated commercially in 1920, and in 1922 Fink developed the first commercial chromium plating bath.

In 1925 Fink and Eldridge developed a most ingenious electrolytic process for reversing corrosion and restoring ancient bronzes. Since that time new processes have come with increasing rapidity. We now have electroplating on aluminum (Work), commercial platinum plating, rhodium plating, the manufacture of powdered metals by electrolytic methods, and most recently, the production of thin sheets of copper by electrodeposition.

The progress of electrochemistry of course includes many specialties besides electroplating. Space does not permit the description of the development of electric furnaces and a number of ferro-alloys. It is clear, however, that the electroplating industry has gathered its full meed of benefit throughout the years.

Material Versus Work Costs

It is a truism that better products can be made from more expensive materials. It is not so generally known, however, that cheaper finished articles can be made with a more expensive raw material because of its ease in handling, working, cutting or assembling. The fact remains nevertheless, as evidenced by the following examples.

It is often cheaper to use die cast parts of zinc or aluminum base to save machining. In many cases it is advisable to put on a specially hard chromium plate for a wearing surface, especially when all-the-way-through hardness is not necessary. It has been shown that it is often cheaper to use brass than iron or steel because of the higher cutting speeds possible with brass and the consequently lower machining costs. This applies also to parts which must be subjected to deep drawing operations. Extruded brass and aluminum are often cheaper than fabricated steel.

It is important in figuring the costs on a job to take into serious consideration the expense of every operation involved, as often a seemingly wide differential in raw material costs is more than wiped out by the differences in machining and assembly work.

Galvanic Corrosion

"Galvanic corrosion" is one of the most commonly used terms in metallurgy and engineering work. It is also one of the most generally misused. An interesting article by Robert Worthington of the International Nickel Company summarizes this complex problem clearly and briefly.

Galvanic corrosion is caused by electrolysis which is defined as the action between two different metals in contact with each other and water. Metals vary over a wide range in their resistance to sea water. For example, copper sheathing on boat bottoms after some months of use shows corrosion around the nail heads. Brass seems to suffer a special type of attack known as dezincification which leaves only a porous and brittle coppery mass. Iron is notorious for its low resistance while lead and zinc suffer slow attack. The point to keep clearly in mind is that galvanic action is only an acceleration, a speeding up of the attack that would take place even without an actual galvanic couple.

The following list of metals, which is known as the "galvanic series," should be kept clearly in mind. Those metals at the head of the list (Group 6 being the head), have a tendency to be corroded when coupled with any metal in another group lower down. In other words, the upper metals are eaten away but bear the whole brunt of the attack themselves, thus protecting the metals below them in the scale.

Group 6	Aluminum Duralumin	Group 3	Soft Solder Tin Lead
Group 5	Zinc Cadmium	Group 2	Nickel Brasses Bronzes Monel Copper
Group 4	Steel Iron	Group 1	Silver Solder Gold

Thus it is clear that zinc when coupled with iron will be attacked, at the same time protecting the iron. Hence the old practice of putting a zinc coating on iron (galvanizing). Similarly, if iron is coupled with copper, the iron will suffer. If two metals in the same group are coupled, there will be a minimum of corrosion.

Galvanic corrosion does not travel far through water. Consequently galvanic attack almost always takes place close to the point of contact between the two metals. The greatest attack is in evidence when the exposed area of the corroded or protecting metal is small as compared with that of the resistant or protected metal. For example, if a steel rivet is used to fasten a large sheet of copper or brass, the attack upon the small rivet will eat it away in a very short time; much more rapidly than upon uncoupled steel. If, on the other hand, the sheet is of steel and the rivet of brass or copper, the corrosion of the iron will be relatively small, and will be confined to a space much less than an inch from the rivet. (This, of course, it must be remembered, applies only to galvanic corrosion. Unprotected iron in water is subject to direct corrosion—not of a galvanic character.) For that reason it is almost always good practice to use the same metal for nails or rivets as is used for the sheathing, and never to use for nails or rivets a metal higher in the above galvanic series than the sheathing.

In couples where neither metal is of large area the galvanic attack is comparatively slight. Also, the use of metals in the same group is quite safe. For example, Monel metal, manganese bronze, Tobin bronze, and ordinary brass are commonly used together without danger. It is better, however, not to use common brass without some tin content. Iron and steel should always be well insulated with paint or some other impervious material in the neighborhood of the less corrodible metals. But it must be remembered that the paint disintegrates and becomes non-protective in time. Hence the use of zinc protecting plates on steel struts and hull parts near large bronze propellers.

Correspondence and Discussion

"A Lot for Your Money"

Editor, METAL INDUSTRY:

I enclose money order for $4 covering 3 years' subscription under your special offer.

Sure get a lot for your money at this rate.

JOHN LOOP,
Electroplater, Malleable Steel Range Company.
Mishawaka, Ind.

From a Veteran Plater

Editor, METAL INDUSTRY:

I wish to thank you for sending me your journal. I surely enjoy reading it as I have done for some years, and especially at this time when I am shut in due to an accident I had last winter. When I was on the road for the Ely Anode Company, I always urged platers to read METAL INDUSTRY.

C. H. BUCHANAN.
Hinsdale, Mass.

"Could Not Keep House Without It"

Editor, METAL INDUSTRY:

. . . thank you for the notice of "Dad's Log." . . . I am already a subscriber to METAL INDUSTRY, a very valuable magazine—could not keep house without it.

THE FRED J. LISCOMB ELECTROCHEMICAL LABORATORY.
Chicago, Illinois.

Technical Papers

Colloidal-Graphited Lubricants. Acheson Oildag Company, Port Huron, Mich. Technical Bulletin No. 92.4.

Syphilis as an Industrial Problem. A Symposium in Journal of Social Hygiene, December, 1932. The American Social Hygiene Association, 450 Seventh Avenue, New York City.

The Chemical Resistance of Rubber as an Engineering Material. By Dr. Howard E. Fritz and J. R. Hoover. B. F. Goodrich Rubber Company, Akron, Ohio. A paper presented at the symposium on rubber of the American Society for Testing Materials, Philadelphia, in 1932.

This paper is a summary of data pertinent to the industrial applications of rubber in resisting corrosion or avoiding contamination. It includes information on the resistance of rubber to solutions used in electroplating.

Recent Developments in Electronic Devices for Industrial Control. By F. H. Gulliksen, Control Engineering Department, Westinghouse Electric and Manufacturing Company, E. Pittsburgh, Pa. A paper presented before the winter convention of the American Institute of Electrical Engineers, January 23-27, 1933. New York City.

In this paper the general characteristics of electronic control devices are outlined, and the features which make the application of these devices desirable from an industrial point of view are referred to. Various recent developments in electronic devices for industrial control are described in detail.

Miscellaneous photo-electric control applications in the industrial field are outlined in an attempt to show the adaptability of photo-electric control equipment to various industries.

A Metal-Connected Glass Electrode, by M. R. Thompson, United States Bureau of Standards, Washington, D. C. Research Paper 511; Superintendent of Documents. Price, 5 cents.

Abstract—Glass electrodes have come into extensive use for the measurement of hydrogenion activity in special cases in which other kinds of electrodes are unsuitable. Previous methods of construction have produced glass electrodes which were fragile, had an uncertain length of life, and required connecting in circuit with two standard electrodes.

In the work reported in this paper a glass electrode was developed which has a comparatively thick wall and a direct metallic connection to the glass. This makes a very durable appartus and eliminates one standard electrode from the circuit. It is shown that the accuracy of such a metal-connected glass electrode is comparable with that of other electrodes used in pH measurement.

Aluminum Alloy Bars. British Standard Specifications. No. 477—1933; No. 478—1933. These, respectively, cover wrought light aluminum alloy bars, including duralumin; and wrought Y-alloy bars. Copies available from Publications Department, British Standards Institution, 28 Victoria Street, London, S.W.1, England. Price, 2s 2d each.

New Books

Handbook of Die Casting Technique. By Leopold Frommer, V.D.I. Buchhandlung, Dorotheenstr. 40, Berlin, N.W. 7, Germany. 686 pages. Obtainable directly from the publishers.

Report of An Investigation Into Metallurgical Processes. Published by V. D. I. Buchhandlung, Dorotheenstr. 40, Berlin, N.W. 7, Germany. This report includes a paper on the centrifugal casting of non-ferrous metals. Obtainable directly from the publishers.

Metal Statistics for 1933. Published by American Metal Market, New York. Size 4 x 6; 480 pages. Price $1.00.

The 26th annual edition of this book is now available. It covers as usual the statistics of metals ferrous and non-ferrous for the past year. The book needs no explanation as it is now a fixture in the library of every business man dealing with metals.

Government Publications

United States Government publications are available from the Superintendent of Documents, Government Printing Office, Washington, D. C., to whom proper remittance should be made to cover price where a charge is mentioned. In some cases, as indicated, apply to governmental body responsible for publication.

Specifications for Copper Silicon Bronze Castings

Copper-Silicon Bronze. Federal Specifications Board, Washington, D. C., has issued free, and requests comment on: Proposed Federal Specification for Bars, Plates, Rods, Shapes, Sheets and Strips of Copper-Silicon Bronze.

Specifications for silicon bronze castings were recently approved for promulgation by the Federal Specifications Board. While many of the requirements are similar to those set for other non-ferrous metal castings, special points are given below:

Composition—silicon, 1.00-5.00; manganese, 1.50 maximum; zinc, 5.00 maximum; iron, 2.50 maximum; tin, 2.00 maximum; impurities, 0.50 maximum; copper, balance.

Physical properties—tensile strength, 45,000 pounds per square inch minimum; elongation in 2 inches, 15% minimum.

Copies of these specifications can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Zinc Industry in 1932—Advance Summary. Bureau of Mines, Department of Commerce, Washington, D. C. Mineral Market Report No. M.M.S. 184. Free from Bureau.

Aluminum Industry in 1932. (Same type data as above, No. M.M.S. 182.)

Brass. Federal Specifications Board, Washington, D. C., has issued sheets on Proposed Federal Specifications for Naval Brass Bars, Plates, Rods, Shapes, Sheets and Strips. Interested parties are requested to comment within 10 weeks of March 24. Sheets free on request. The same applies to:

Zinc Plates, Sheets and Strips; Proposed Revision F. S. No. 531.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

ASSOCIATE EDITORS

Metallurgical, Foundry, Rolling Mill, Mechanical

H. M. ST. JOHN — W. J. PETTIS
W. J. REARDON — W. B. FRANCIS

Electroplating, Polishing, and Metal Finishing

O. J. SIZELOVE — A. K. GRAHAM, Ph.D.
G. B. HOGABOOM — WALTER FRAINE

Black Nickel

Q.—Enclosed is a sample of black nickel work with which we are having trouble. The piece is brass, buffed, nickel flash and black nickeled for ½ hour. This sample piece is ready to be colored on a light cotton buff with lamp black and oil, but they are unable to color it and remove the streaks without cutting it through. The work was rinsed in cold water and then hot water for drying after plating. The black nickel solution contains about 1½ ozs. of metal per gal., and is backed up with old nickel anodes.

The pH is about 7.

A.—The appearance of the sample would indicate that the current used was too great. We would suggest that you use slightly less than 1 volt and that you add 1 pint of a cyanide copper or brass solution to each 100 gallons of the black nickel solution.

If these suggestions do not help to overcome your trouble, send us a sample for analysis.

O. J. S., Problem 5,184.

Black and Satin Finished Aluminum

Q.—We have a problem for which we desire information. We have an extruded aluminum moulding on which we desire to apply a satin finish with black in the low relief. This moulding is used for exterior purposes and it is imperative that the black finish be rather hard or permanent and weatherproof.

This moulding is in sections about 18 feet long. If it is possible we prefer to use a non-electrolytic process, but if it cannot be avoided, we will do otherwise. Is there a colored vitreous or hard porcelain compound or powder that will harden when mixed or applied and have the same effect as the colored inlay work as used on bronze elevator doors?

A.—We would suggest the use of a black synthetic enamel to be used on the aluminum moulding. This material can be purchased from the lacquer manufacturers and should be applied preferably by spraying although it may be applied by brushing.

If sprayed, the work should be satin finished and the raised parts shielded before spraying. It will be necessary to dry the synthetic enamel at a temperature of 250 to 350° F., for 30 minutes to one hour to produce a hard surface and one that will stand up very well for exterior purposes. O. J. S., Problem 5,185.

Bluing Gun Barrels

Q.—How can I blue gun barrels without plating them?

A.—The method of producing a blue black or gunmetal finish is as follows:

After the work has been polished and cleaned, it is placed in the following solution for ten to fifteen minutes.

Ferric chloride	2 ozs.
Mercury nitrate	2 ozs.
Muriatic acid	2 ozs.
Alcohol	8 ozs.
Water	8 ozs.

USE THIS BLANK FOR SOLUTION ANALYSIS INFORMATION

Fill in all blanks if posible.

Date .....

Name and address: .....**Employed by:** .....

Kind of solution: .....**Volume used:** .....

Tank length: .....**width:** .....**Solution depth:** .....

Anode surface, sq. ft.: .....**Cathode surface, sq. ft.:** .....

Distance between anode and cathode: .....**Kind of anodes:** .....

Clas of work being plated: .....**Original formula of solution:** .....

REMARKS: Describe trouble completely. Give cleaning methods employed. Send small sample of work showing defect if possible.

Use separate sheet if necssary.

NOTE: Before taking sample of solution, bring it to proper operating level with water; stir thoroughly; take sample in 2 or 3 oz. clean bottle; label bottle with name of solution and name of sender. PACK IT PROPERLY and mail to METAL INDUSTRY, 116 John Street, New York City.

After immersing the work in this solution, it should be hung up to dry for 10 to 12 hours. Repeat the immersing and drying operations, then brush lightly with a fine crimped steel wire wheel. Finally, oil with paraffine or linseed oil and remove excess of oil with a soft cloth.

O. J. S., Problem 5,186.

Brass Solution Problems

Q.—1. Does carbonate of soda always have to be used for bisulphite of soda in brass solution, and how much? Say I'd have to use ½ lb. of bisulphite of soda in brass solution; how much carbonate of soda to neutralize?

2. Are contents the same for brass solution if copper anodes are used?

3. Is there a difference between the following: too concentrated; too dense?

4. In problem 3,429 January, 1926, French Brown:

What does Chlorate of Potash do?

What does Sulphate of Copper?

In above mentioned solution if solution becomes too weak, are additions made? Or a new solution?

Why is it that zinc salts have to be added so seldom in brass solution?

5. Is there any difference in the following?

Potassium Chlorate. Chlorate of Potash.

6. Caustic Potash. Caustic Soda.

7. Which is the best to use to keep anodes clean, Rochelle salts or caustic soda? Which is the less harmful for brass solution?

A.—1. Carbonate of soda or bisulphite of soda is seldom, if ever used in a brass solution. Should they have been used, one would not neutralize the other after they were added to the solution.

2. Yes.

3. No.

4. Make new solution.

5. No.

6. One is a potassium salt and the other a sodium salt.

7. Rochelle Salts.

O. J. S., Problem 5,187.

Brittle Nickel

Q.—We are sending you today under separate cover a sample of our nickel plating solution.

Deposits obtained from this solution show a marked tendency toward cracking especially in the high current density areas, and likewise they are very brittle. As far as we know there is no organic matter or brightener in the solution which would cause this.

A.—Analysis of Nickel Solution:

Metallic Nickel	2.41 oz.
Chlorides	3.12 oz.
pH	5.2

While the metal content is somewhat too low the pH is entirely so and it is this factor that causes a brittle deposit.

We would suggest that you add 75 lbs. of single nickel salts, 90 fluid ozs. of 26° ammonia and one gallon of 100 volume hydrogen peroxide to the solution. After making these corrections stir the solution thoroughly and let stand over night before using.

O. J. S., Problem 5,188.

Casting Bronze in Plaster of Paris

Q.—We were recently told that bronze memorial tablets are being cast in plaster paris molds instead of molding sand with very good results. This method is entirely foreign to us, and if you are in position to give us full details as to how the plaster paris is prepared and how it is applied to the face of a pattern for a bronze tablet, we will appreciate it very much. We would also like to know if there is danger of the plaster sticking down when drawing the pattern and if the metal is apt to blow when poured on to the plaster.

A.—We have no record of bronze memorial tablets being cast in plaster molds. However, there are a lot of castings being made in plaster today. One method is to take 90% plaster, 10% lime; mix with 1 quart of water to 3 lbs. plaster. Pour over patterns in suitable flask. Gate the same as for sand molds. Pattern must be arranged with pattern drawing apparatus so the drawing of the pattern is mechanical, as any nervous drawing of the pattern spoils the mold.

Dry in the oven at 600 deg. F., for 10 hours. Take mold from oven and pour as soon as possible. It is necessary that the even temperature must be held steadily at 500 to 600 deg. F. Very fine castings are produced this way, but unless the drying is done properly, the metal will blow.

W. J. R., Problem 5,189.

Depositing Cadmium by Friction

Q.—Some time ago I wrote you about a street man who was selling a silver and chromium plating compound. He did it by rubbing the compound on the metal. You told me the method used for this kind of plating with silver, but you told me that you had never heard of any such chromium plating that is done by the rubbing method.

You suggested that cadmium is sometimes passed off as chromium. If cadmium plating can be worked by rubbing the same as silver, I should be very pleased if you could tell me the amount and the different ingredients to get.

A.—We would suggest that you use cadmium nitrate in place of the silver nitrate in the formula given you.

If you can procure a sample of the material and send it to us, we will advise you further.

O. J. S., Problem 5,190.

Eliminating Buff Marks on Lacquer

Q.—In finishing of brass we use clear and gold lacquer on a highly polished surface. We are having trouble to eliminate buff marks. How can we remedy this?

Our lacquer seems to dry with a rough surface. We use a late model spray gun for applying the lacquer and allow it to dry in the lacquering room at room temperature.

A.—You can only eliminate the buff marks from the brass work by using the proper buffing and polishing methods.

If the brass work is made from castings, they should be roughed out by using No. 80 or No. 100 emery glued to a rag or felt wheel, then grease buffed, using No. 150 or No. 180 emery glued to a rag or felt wheel. The work should then be cut down, using a stitched buff with tripoli, and then colored, using a loose leaf buff, and a lime composition.

If the work is rolled brass, you can eliminate the roughing out and probably the grease buffing operations.

The rough surface that you obtain from the lacquering operation is due to improper mixing of the lacquer, improper adjustment of the spray gun, improper application of the lacquer, or possibly the kind of lacquer that you are using. Consult your lacquer representative, as we are sure that he can help you with your lacquer problem.

O. J. S., Problem 5,191.

Rough Nickel

Q.—What is the cause of the roughness of the nickel deposit in the enclosed sample?

A.—The roughness of the nickel deposit is caused by the deposition of "non-metallics," mechanically with the nickel deposit, and the best way to prevent a rough deposit from this cause is to filter the solution and then place the nickel anodes in muslin bags.

O. J. S., Problem 5,192.

Very White Gold Finish

Q.—I would appreciate your sending me a formula to make a solution for whitening white gold to make it look like platinum.

A.—The following tin solution is used in the jewelry trade to produce a white finish on white gold to prevent tarnishing.

Stannous chloride	½ oz.
Caustic soda	1 oz.
Sodium cyanide	1 oz.
Water	1 gallon.

Operate solution at 180° F. with 4 volts.

Lately rhodium plating has come into use for a flash deposit on white gold work and is proving very successful.

O. J. S., Problem 5,193.

Patents

A Review of Current Patents of Interest

Printed copies of patents can be obtained for 10 cents each from the Commissioner of Patents, Washington, D. C.

1,896,079. February 7, 1933. **Automatic Conveyor for Chemical and Electrochemical Operations.** Wesley F. Hall, Matawan, N. J., assignor to Hanson-Van Winkle-Munning Company, Matawan, N. J.

1,896,141. February 7, 1933. **Protecting Metallic Surfaces of Refrigerators from Sulphur Compounds.** Isidor Kitzee, Philadelphia, Pa.

1,896,193. February 7, 1933. **Constant Resistivity Alloy.** Michael G. Corson, Jackson Heights, N. Y., assignor to Weston Electrical Instrument Corporation, Newark, N. J.

1,896,201. February 7, 1933. **Process of Separating Oxides and Gases from Molten Aluminum and Aluminum Alloys.** Roland Sterner-Rianer, Heilbronn-on-the-Neckar, Germany.

1,896,406. February 7, 1933. **Powdered Anhydrous Magnesium Chloride and Method of Making Same.** Sheldon B. Heath, Midland, Mich., assignor to The Dow Chemical Company, Midland, Mich.

1,896,410. February 7, 1933. **Tarnish Resistant Alloy.** Robert H. Leach, Fairfield, Conn., assignor to Handy & Harman, New York, N. Y.

1,896,411. February 7, 1933. **Corrosion Resistant Metal Plate and Process of Making the Same.** Alfred E. Maskrey, Irvington, N. J., assignor, by mesne assignments, to The Plykrome Corporation, New York, N. Y.

1,896,473. February 7, 1933. **Article of Metallic Compositions or Alloys of Lead.** John R. Townsend, Bloomfield, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y.

1,896,594. February 7, 1933. **Wrinkle Coating.** Frank Brian Root, East Orange, N. J., assignor to Chadeloid Chemical Company, New York, N. Y.

1,896,613. February 7, 1933. **Process of Treating Zinc-Coated Wire.** Frank F. Fowle, Winnetka, Ill., assignor to Indiana Steel & Wire Company, Muncie, Ind.

1,896,823. February 7, 1933. **Polishing Composition and Method of Preparing Same.** Paul Logue, Birmingham, Ala., and Theodore W. Schilb, St. Louis, Mo., assignors to Swann Research, Inc., a Corporation of Alabama.

1,897,066. February 14, 1933. **Method of Casting Straps for Battery Plates.** Arthur Mayer, Detroit, Mich. Original application filed Sept. 26, 1930. Serial No. 484,601.

1,897,149. February 14, 1933. **Process of and Product for Attaching Portions of Molds or Cores.** Charles Marshall Saeger, Jr., Bowmanstown, Pa.

1,897,183. February 14, 1933. **Method of and Material Employed in the Manufacture of Refractory Articles.** Harold E. White, Zelienople, Pa., assignor to Lava Crucible Company of Pittsburgh, Pittsburgh, Pa.

1,897,308. February 14, 1933. **Apparatus for Electrolysis of a Fused Bath.** Ralph M. Hunter, Midland, Mich., assignor to The Dow Chemical Company, Midland, Mich.

1,897,360. February 14, 1933. **Manufacture of Stannic Chloride.** William James Buttfield, North Plainfield, N. J., assignor to The Vulcan Detinning Company, Sewaren, N. J.

1,897,433. February 14, 1933. **Die-Casting Machine.** Torbjorn C. Korsmo, Madison, Wis., assignor to Madison-Kipp Corporation, Madison, Wis.

1,897,589. February 14, 1933. **Melting and Casting of Metals.** Howard T. Reeve, Millburn, N. J., assignor, by mesne assignments, to Western Electric Company, Incorporated, New York.

1,897,813. February 14, 1933. **Metal Cleaning Composition.** Harry C. Mougey, Detroit, Mich., assignor to General Motors Research Corporation, Detroit, Mich.

1,898,437. February 21, 1933. **Method for Casting Readily Oxidizable Metals Such as Magnesium and Alloys Thereof.** John A. Gann, James B. Reid, and Hans A. Reimers, Midland, Mich., assignors to The Dow Chemical Company, Midland, Mich.

1,898,487. February 21, 1933. **Method of Uniting Metal Parts and Article Produced Thereby.** Roy T. Hurley, Dobbs Ferry, N. Y.

1,898,618. February 21, 1933. **Process and Apparatus for Electroplating.** Frederick Conlin, New York, N. Y.

1,898,671. February 21, 1933. **Die Casting Machine.** William M. Lester, Shaker Heights, Ohio.

1,898,765. February 21, 1933. **Electrocleaning Process.** Thomas E. Dunn, Bridgeport, Conn., assignor to The Bullard Company, a Corporation of Connecticut.

1,898,809. February 21, 1933. **Process for Cleaning Metal Objects.** Robert B. Berg, Aurora, Ill., assignor to National Rail Joint Corporation, Chicago, Ill.

1,898,917. February 21, 1933. **Process of Welding Aluminum or Alloys Thereof to Other Metals.** Heinrich Wachwitz, Nuremberg, Germany, assignor to Vereinigte Silberhammerwerke Hetzel & Co., Nuremberg, Germany.

1,898,933. February 21, 1933. **Welding Rod.** Howard William R. Biers, Forest Hills, N. Y., assignor to Oxweld Acetylene Company, a Corporation of West Virginia.

1,898,969. February 21, 1933. **Method of Protecting Magnesium and its Alloys at Elevated Temperatures.** Edwin O. Barstow, Midland, Mich., assignor to Dow Chemical Company, Midland, Mich.

1,899,031. February 28, 1933. **Apparatus for Separating Metals or Alloys.** Albert Hanak, Philadelphia, Pa., assignor to Girard Smelting & Refining Company, Philadelphia, Pa.

1,899,054. February 28, 1933. **Lacquer-Base, Lacquer and Method of Making Same.** Willett C. Pierson, East Orange, N. J., assignor to Leagum Corporation of Delaware, New York, N. Y.

1,899,133. February 28, 1933. **Light Aluminum Alloy.** Max Bosshard, Neuhausen, Switzerland, assignor to Aluminium Industrie Aktiengesellschaft, Neuhausen, Switzerland.

1,899,132. February 28, 1933. **Pigmentary Base Product and Process for Making the Same.** Axel Viggo Blom, Grosshoechstetten, Switzerland.

1,899,148. February 28, 1933. **Noncorrosive Alloy and Method of Making and Using the Same.** Wilford J. Hawkins, Claiborne, Md., assignor to American Machine & Foundry Company, a Corporation of New Jersey.

1,899,150. February 28, 1933. **Fluid Operated Tool.** John R. Hoffman, Madison, Wis., assignor to Madison-Kipp Corporation, Madison, Wis.

1,899,153. February 28, 1933. **Composition for and Method of Treating Molten Metals.** William R. Jeavons, Cleveland Heights, and Mahlon J. Rentschler, Willoughby, Ohio.

1,899,252. February 28, 1933. **Buffing Wheel Blank Plies.** Harry Zimmermann, Toronto, Ontario, Canada, assignor to Beulah Belle Zimmermann, Toronto, Ontario, Canada.

1,899,387. February 28, 1933. **Process of Coating Articles with Liquid Pyroxylin or the Like.** William C. Hampton, Dayton, Ohio, assignor to The Crawford McGregor and Canby Company, Dayton, Ohio.

1,899,465. February 28, 1933. **Aluminum Alloy.** Otto Kamps, Berlin, Germany.

1,899,569. February 28, 1933. **Process of Coating Metals.** Goodwin H. Howe, Scotia, N. Y., assignor to General Electric Company, a Corporation of New York.

1,899,623. February 28, 1933. **Electrode Alloy.** Erwin F. Lowry, Forest Hills, Pa., assignor to Westinghouse Electric & Manufacturing Company, a Corporation of Pennsylvania.

1,899,679. February 28, 1933. **Barrel Plating Apparatus and Process.** Colin G. Fink, New York, N. Y., and Ralph D. Eash, East Orange, N. J., assignors to Chemical Treatment Company, Inc., New York.

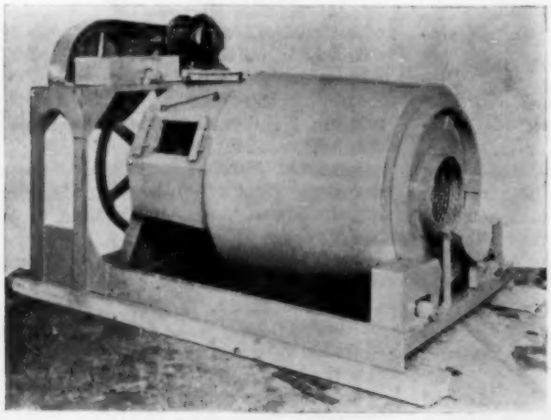
1,899,873. February 28, 1933. **Alloy.** Robert H. Leach, Fairfield, Conn., assignor to Handy & Harmon, New York.

Equipment

New and Useful Devices, Metals, Machinery and Supplies

Ideal Ball-Return Side-Loading Burnishing Barrel

A new departure in burnishing equipment which, it is claimed, results in a saving in time and labor, a better finish of the work and a definite and substantial reduction in burnishing costs, is announced by N. Ransohoff, Inc., Cincinnati, Ohio.



New Side-Loading Burnisher

The saving in time and labor is accomplished by the method of unloading the barrel, automatic separation of the balls from the work and automatic return of the balls to the burnishing compartment. The work is loaded into the Ideal barrel through a door in the periphery, somewhat as in the case of the standard barrel where the diameter is greater than the length. A cylindrical screen is attached to the end of the burnishing section and connected to it by a suitable passage of patented design. This screen is surrounded by a cone for retaining the balls after separation from the work and this cone is connected to the burnishing compartment by a patented passage.

After the burnishing has been completed, reversing the direction of rotation discharges the work and the balls into the screen. Here the balls are separated from the work, the former falling through the perforations in the screen into the surrounding cone and the latter passing out from the end of the screen. The barrel is then stopped and loaded with another batch of work. Running again in the burnishing direction automatically returns the balls from the cone to the burnishing section. This automatic handling of the balls **eliminates all the labor** of handling them and the time required to empty and reload the Ideal barrel is said to be about five minutes as compared to thirty minutes for the old type barrel where **manual** separation of the balls from the work and manual return of them to the barrel is required. In addition to this great saving, a greater quantity of balls can be used than is economical in the old type barrel. This results in a faster and better burnishing action.

The advantage claimed for the end discharge is that it permits of a greater diameter in the burnishing compartment without excessive loading height. This greater diameter and the use of more balls produces an increased burnishing pressure resulting in better and faster operation, while the end discharge also permits the whole equipment to be built close to the floor. Ten sided drum, sides and ends lined with maple. Three point suspension, one long flat bearing at loading end, two chilled rollers running in roller bearings at discharge ends. Power from 720 R.P.M. motor through V belt drive and cut gear and pinion.

Direct Motor Drive Spinning Lathe

A spinning lathe is being manufactured by the Thomas Fruin Machine Company, 503 Fifth Avenue, New York, which, it is stated, has some unusual features. It is driven by a direct connected motor and it has ball bearings throughout. The motor is cooled by aluminum fans placed on the armature to drive the air through it. Air vents are screened to prevent flying metal from entering the motor. Ball bearings are completely enclosed and protected from dust and dirt, and are lubricated by the "Dot" system.

Fruin Spinning Lathe

Latest Products

Each month the new products or services announced by companies in the metal and finishing equipment, supply and allied lines will be given brief mention here. More extended notices may appear later on any or all of these. In the meantime, complete data can be obtained from the companies mentioned.

Liquid Porcelain Cement. Suitable for assembling metal parts. Henry L. Crowley and Company, West Orange, N. J.

U. S. Synchrogear Motor. A new development in geared power with novel pyramidal structure. U. S. Electrical Manufacturing Company, Los Angeles, Calif.

Geared-Head Motoreducer. A combination of motor and gear unit specially designed for relatively low ratios, both speed reduction and speed increase. Falk Corporation, Milwaukee, Wis.

Portable Manhole Ventilator. Designed for use where electric power is not available; gasoline engine driven. Coppus Engineering Corporation, Worcester, Mass.

Small Motors. A line of 3 H. P. motors in standard and special types. Emerson Electrical Manufacturing Company, St. Louis, Mo.

Turbadium. A manganese brass which includes nickel, with the composition: copper, 50; zinc, 45; nickel, 2.0-2.25; iron, 0.8-1.0; tin, 0.5; manganese, 1.5-2.0. Tensile strength of over 80,000 pounds per square inch is claimed; also erosion resistance. Manganese Bronze and Brass Company, Ltd., London, England.

Cellophane for Storing Motors. A description of the way in which cellophane prevented the marring of the lacquer finish on motors for electrical refrigeration while they were piled one upon the other in the plant immediately after finishing. Dupont Cellophane Company, 350 5th Avenue, New York.

Superchrome. A process of chromium plating which, it is stated, uses no sulphates or sulphuric acid; also said to have a wide bright plating range. Electroplaters' Technical Institute, 619 Wellington Avenue, Chicago, Ill.

Motor Speed Reducers. Type S Gearmotors to reduce normally high motor speeds to satisfactory operating speeds; designed for drives ½ to ⅛ horsepower. Westinghouse Electric and Manufacturing Company, E. Pittsburgh, Pa.

Indirect Heating Surface. K-Fin Bentube Heater, for use in heating and ventilating, air conditioning and cooling systems. Made by the Griscom-Russell

Company, distributed by Hitchen Engineering Company, Inc., 155 East 44th Street, New York City.

New Nichrome Alloys. A new series of alloys of the nichrome type to be known as Nichrome V. Driver-Harris Company, Harrison, N. J.

Fine Fuses. Delicate electrical devices using platinum wire 30 times finer than a human hair in a new 1/100th ampere instrument fuse. Complete details are given in Catalog No. 5. Littelfuse Laboratories, 1772 Wilson Avenue, Chicago, Ill.

Murex Straight Gap Welding. A new process which does away with need for "veeing" or grooving of plate edges; also Murex Heavy Mineral Coated Electrodes. Metal and Thermit Corporation, 120 Broadway, New York.

The Deoscillator

Anticipatory control action may be obtained, it is claimed, with any pyrometer controller by adding the Deoscillator, a new auxiliary device developed by the Foxboro Company of Foxboro, Mass. This anticipating action improves control operation by eliminating "hunting" or over-controlling.

The Deoscillator is "cut-in" between the thermocouple and the controller. In operation, the instrument impresses into the thermocouple circuit a slight additional E. M. F. that augments the thermocouple E. M. F. when the temperature is low and opposes it when the temperature is high. This causes the controller to close either the high or low circuit a little ahead of the actual temperature demand. The anticipatory effect prevents excessive overrun or underrun of the desired temperature.

Foxboro Deoscillator

Adjustment to the requirements of the particular heating equipment on which the Deoscillator is installed is quickly and easily made. Once the instrument is set correctly, that setting will hold for practically any condition from no load to full load. The Foxboro Company has prepared a preliminary description of the Deoscillator which readers may have by writing them at Foxboro, Mass.

Coloring Aluminum and Its Alloys

By Dr. L. C. PAN

Technical Director, the United States Research Corporation, Long Island City, N. Y.

Aluminum is light in weight. It has a pleasing white color, but it has one drawback. It has only one color, and it is difficult to give it a permanent colored finish such as lacquering, painting or varnishing. This compels many users of the metal to retain the original white metallic color, which in many cases becomes monotonous.

Aluminum also corrodes under ordinary atmospheric conditions, especially in cities and densely inhabited localities. A shiny white aluminum surface is too often quickly marred by corrosion spots, which spring out like a disease on the metal.

Because of the above drawbacks, there has recently been developed a new process, called Coloral, by which aluminum and its alloys are so treated that they are practically immune from atmospheric corrosion. By the same process they may also receive attractive colors, which are durable and unlimited in their various shades and

Product Showing Coloral Finish Treatment

color harmonies. This new process is applicable to ordinary aluminum—aluminum of all strengths and tempers, and alloys, such as are used in die casting and sand casting, in which aluminum is the main constituent. Aluminum alloys often suffer from corrosion faster than pure aluminum. The Coloral process, however, eliminates this defect and renders the alloys as resistant to corrosion as the pure aluminum.

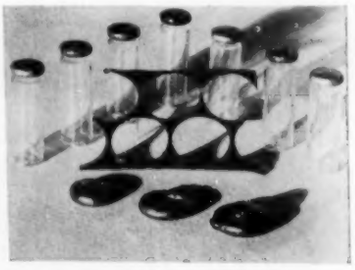
Ordinarily, aluminum is easily scratched. The Coloral process hardens the surface, protects the aluminum against scratching and minor mechanical injuries, and maintains a lustre in brilliant colors.

One of the outstanding features of the Coloral process is that the finish is like an integral part of the metal itself. There is no peeling. The bond between the finish and the metal is illustrated by one specific case in which the metal is colored in the sheet form and afterwards punched and formed into caps without scratching, breaking or chipping the finish.

The finish is inert chemically. Its color is as fast as any lacquer, varnish or paint. It is not affected by organic acids or soaps, fruit juices or foodstuff. This makes it useful in decorating aluminum utensils, cups, trays, and similar articles. It is resistant to heat. Both the plain and the colored finishes are unaffected even up to 400° F.; sometimes higher. This makes it applicable to parts of electric toasters, flat irons, and other heating apparatus.

The coloral finish acts as an electrical insulator. A test was made in which the voltage applied was raised to 170 across the Coloral coating and the temperature rose to 500° C. without breaking the insulation.

The process itself is simple and economical to operate. All that is required is a few chemical baths and a source of electric current. The baths may be operated at ordinary temperatures without heating or cooling. They do not give off obnoxious odors or fumes. The time required is less than a half hour.



Bottle Caps Stamped from Coloral Treated Sheets

The Coloral process neither obscures nor injures fine details on objects, and does not require subsequent polishing or buffing to bring out the high lustre.

The cost of the process is extremely low. In quantity production it amounts to less than one cent per square foot.

Stoneware Jars

A new type of stoneware jar with an air tight cap has been placed on the market by the U. S. Stoneware Company, 50 Church

Jar with "Loxeal" Cap

Street, New York. This jar, trade marked "Loxeal," features the closure which is said to be positively air and leak proof. The jar is recommended for preserving chemicals from evaporation, spillage, etc. It is said to be incorrodible, non-absorbent and sturdy. Sizes available range from ½ to 6 gallons.

Useful Kerosene Torches

The torch shown in the illustration is the Torit No. 8-K Outfit, made by the Torit Manufacturing Company, St. Paul, Minnesota, and is being used to preheat a large gear which came to the welding shop broken through the hub in three parts and with two spokes broken. The parts were set back in place and held together as shown. The entire gear was then preheated with the Torit Torch, which it is claimed, eliminated any troubles that might have come from expansion and contraction, after which "soft," easily-machined welds were made.

Torit kerosene torches, which may be had in many styles, can be used for many other jobs besides preheating in connection with welding, such as for heating tar, pitch, asphalt, for bending and straightening heavy metal parts, for flanging, for lighting foundry cupolas, for thawing, for drying, and for hundreds of jobs where a large, hot flame is wanted.

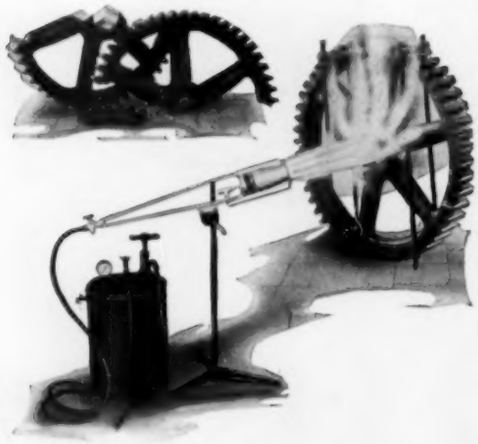
Full details on the complete line of Torit Kerosene Torches may be had by writing to the manufacturers, the Torit Manufacturing Co., 178 West Third Street, St. Paul, Minn.

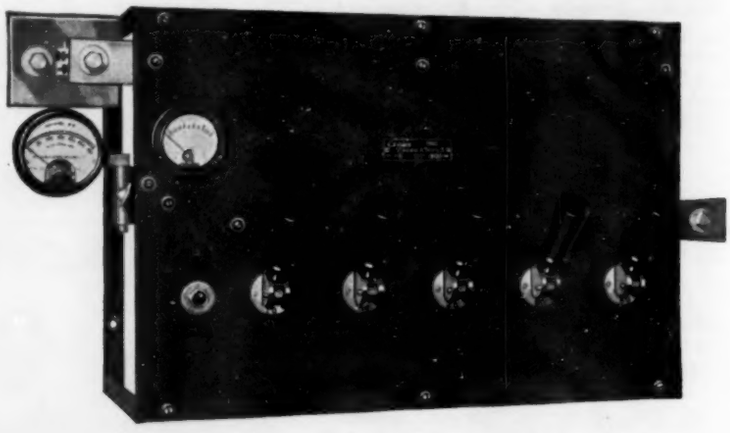
New Rheostat

A new type of rheostat is now being marketed by the Udylite Process Company, Detroit, Mich., called the Crown Type T Toggle Switch rheostat. It is designed to enable the electroplater to adjust the resistance of a plating tank circuit so as to regulate the current density in the circuit with the minimum number of switches. This regulation is obtained by manipulation of the various resistance units that are controlled by the switches, all switches being plainly marked as to their capacity in amperes.

The ammeter readings give the total volume of the current passing through the solution, so that with the work surface known, the current density can be readily calculated, and then the amount of deposit in a given time is easily determined.

All switches are of the toggle type, dead when open, and are liberally rated for capacity.





Above, Left—New Torit Kerosene Torch in Use for Preheating a Gear, the Broken Parts of which Are Shown in the Upper Left Corner. Right—New Type Rheostat for Electroplating Tanks.

Equipment and Supply Catalogs

Available free on application to the manufacturers mentioned, unless otherwise stated. Please mention this notice.

Chain Drive Equipment. Chain Belt Company, Milwaukee, Wis. Bulletin 231.

Fuses. Littelfuse Labs., 1772 Wilson Avenue, Chicago, Ill. Catalog No. 5; all types of fuses.

Optical Instruments. Bausch & Lomb Optical Company, Rochester, N. Y. April, 1933, issue of "The Educational Focus," a journal. Free.

Industrial Cooperative Gardening. The B. F. Goodrich Company, Akron, Ohio. Story of a farm plan for employees, sponsored by Goodrich. Well illustrated.

Metal Cyanides for Plating Solutions. R. & H. Chemicals Department, E. I. du Pont de Nemours & Company, Inc., Wilmington, Del. Good booklet, with formulas.

Combating Chemical Corrosion with Alcoa Aluminum. Aluminum Company of America, Pittsburgh, Pa. Excellent illustrated booklet of 44 pages. Describes various alloys and their applications.

Rubber Lined Pickling Tanks. The B. F. Goodrich Rubber Company, Chemical Sales Division, Akron, Ohio. Bulletin 9021, in tanks with "Triflex" linings. Completely illustrated, with full data on construction, etc.

Fire Brick. McLeod and Henry Company, Troy, N. Y. A 16-page booklet on "Steel Mixture" brand of fire brick for oil fired furnaces. Also describes other types of brick, cements, plastic refractories, furnace linings, etc.

Beryllium Copper. The Riverside Metal Company, Riverside, Burlington County, N. J. Excellent booklet on sheet, strip, wire and rod of beryllium copper, a heat treatable copper alloy. Gives complete data as to composition, properties, heat treating, applications, etc.

Government Extravagance. "The Cause of Price Cutting," by Allen W. Rucker in collaboration with N. W. Pickering, president Farrel-Birmingham Company, Ansonia, Conn. This is an unusually informative booklet which analyzes thoroughly the destructive effect of ignorant price-cutting. It shows in tabular form what happens to profits with 5% cut in price, and how much additional business is necessary to replace these profits. Price-cutting is also linked to governmental extravagance. The authors point out that the use of Federal Reserve funds to purchase government securities cuts off these funds from business, restricting business operations, decreasing the purchasing power of business, which results in fewer orders, then more intense competition, and finally destructive price-cutting. Copies can be obtained free from Farrel-Birmingham Company, Inc., Ansonia, Conn.

Centrifugal Machines with Hot Blast

American Tool and Machine Company, 1427 Hyde Park Avenue, Boston, Mass., which has been manufacturing centrifugal machines for many years, announces a type of machine especially designed for handling metal work. This machine features a hot-blast unit which is independent of the centrifugal. The machine is stated to be highly efficient for drying metal products after processing, as well as for soaking, rinsing, drying and also coating. In coating, the centrifugal action is used to spin off excess liquid, while the hot blast sets the coat or completes the drying. In plain drying operations, according to the maker, a continuous warm air blast quickly completes drying before oxidation can begin, after most of the liquid has been thrown off centrifugally. Work is said to be delivered clean and bright in a fraction of the time required for sawdust tumbling. Heat is supplied by steam, gas-firing or electrically, according to user's needs.

Features of construction stressed include cone-mouthed baskets for easy unloading; baskets with drop bottom; motor bracket designed so that motor can be removed and idlers mounted; heating element of seamless tubing, crimped copper fins. Propeller fan moves air in parallel lines, without turbulent flow. Interlocking brake cuts off motor when applied, and prevents starting when brake is on.

Centrifugal Machine for Coating and Drying Metals, with Hot Blast Unit Attached

Powdered Solder

A powdered solder has been placed on the market by Roberts and Davis Company, Inc., Chicago, Ill., which they call Lotan solder. This material when mixed with a flux is said to melt at a temperature of about 100 degrees lower than ordinary solder, and re-melts at a temperature slightly higher than common solder does, thus giving a greater differential than is usually obtainable.

Impurities are said to total less than 1 per cent and tensible strength, from 100 to 300 per cent more than ordinary solder.

The Lotan flux is provided already mixed into the powdered solder which makes other fluxes unnecessary, it is stated.

Personals

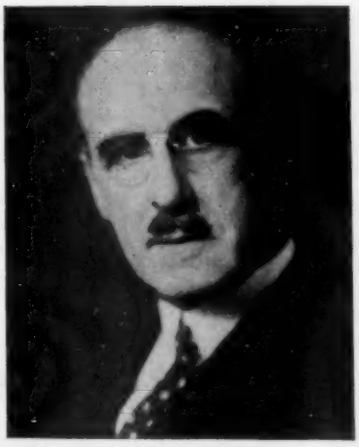
Dr. Frederick M. Becket

With the election of Dr. Frederick M. Becket as president for the coming year, the American Institute of Mining and Metallurgical Engineers is again under the leadership of a metallurgist, after two terms held by members of the mining side of the Institute. That the choice is satisfactory to all, however, there can be no doubt.

Dr. Becket is a leading electro-metallurgist, holder of the 1924 Perkin Medal given by The Electrochemical Society, of which he has also been president. He is, as far as business is concerned, vice-president of three major corporations: Union Carbide Company, Electro Metallurgical Company and Haynes Stellite Company. Besides this, he is a director of United Chromium, Inc., and Udylite Process Company. These high positions are the fruits of a career which has been marked by a thoroughness and persistence which have led him to make some highly important contributions to electro-chemistry and electro-metallurgy.

Dr. Becket graduated from McGill University in Canada, and went to the United States to take a job with Westinghouse. After some time he went to Columbia University where he won a Master's degree. He left Columbia in 1903 and organized the Niagara Research Laboratories. He has been with that company and its successors ever since.

Niagara Research Laboratories was acquired by Electro Metallurgical in 1907, and is now a unit of the Union Carbide and Carbon Corporation.



DR. FREDERICK M. BECKET

Dr. Becket's early work was largely concerned with caustic soda and chlorine production, direct production of steel from iron ore, and production of chromium, tungsten, molybdenum, vanadium and low-carbon ferroalloys. A most important development was his commercial process for manufacturing ferrovanadium. Dr. Becket has used the electric furnace extensively in his metallurgical work. He has obtained about 100 United States patents.

Oscar E. Planteroth has been elected chairman of the board and president of Marks Lissberger and Son, Inc., Long Island City, N. Y., metal producers and dealers. **Frank Buffell** has been elected vice-president and **E. E. Lissberger** secretary-treasurer. The new official personnel resulted from the recent death of M. L. Lissberger, former head of the company.

Ludwig Vogelstein, board chairman of American Metal Company, Ltd., New York, is chairman of the Non-Ferrous Metals Division of the Trade and Industry Committee of the Salvation Army United Appeal which is making a drive for $1,110,000.

James Kniveton, formerly in charge of electric heat treating furnace design for Ryan Scully and Company, has joined the staff of Ajax Electric Company, Inc., Philadelphia, Pa., the division of Ajax Metal Company which manufactures electrically heated industrial furnaces.

William F. Diesel, for the past 10 years vice-president, has been elected president of Sargent and Greenleaf, Inc., Rochester, N. Y., to succeed the late William R. Hill. **Clarence W. Quinn,** formerly secretary and assistant treasurer, is now vice-president and treasurer. **James G. Dale** is secretary. The company operates a complete nonferrous foundry, and plating, polishing, grinding and lacquering departments.

E. H. Merrick, 3020 Coleridge Road, Cleveland Heights, Ohio, has been appointed exclusive sales representative in northern Ohio for "Falcon" continuous electric heat treating furnaces and bare electric immersion heaters for viscous materials, made by H. O. Swoboda, Inc., 3530 Forbes Street, Pittsburgh, Pa.

Obituaries

F. W. Reidenbach

F. W. Reidenbach, widely known member of the metal smelting and refining industry and former president of the National Association of Waste Material Dealers, died February 24, 1933, at his home in Rochester, N. Y. He was 69 years of age.

The career of Fred Reidenbach covered many years of active interest in the non-

F. W. REIDENBACH

ferrous metals field. He started with Woodfall Brothers, and later went to the Ajax Metal Company, Philadelphia, Pa. In 1893 he formed the Malta Metal Company at Rochester, specializing in phosphor tin production. In 1902 he went with the Genesee Metal Works of the Levi-Hey Company, which later became the Genesee Metal Company. In 1916 he helped to organize Coates, Bennett and Reidenbach, Inc., of which he was first the vice-president and general manager, later the president. A few years ago he organized the Genesee Purchase and Sales Company, to deal in scrap and secondary nonferrous metals. He had retired from active business some time before his death.

Frank Edson Dean

Frank Edson Dean, vice-president of the Associated Silver Company, Chicago, Ill., cutlery and silverware manufacturers, died March 24, 1933. Mr. Dean was 63 years old. He was prominent in the trade, having been chairman of the National Jewelers Credit Association.

L. Wenk

L. Wenk, vice-president of the U. S. Reduction Company, East Chicago, Ind., died February 18, 1933. Mr. Wenk came to the U. S. in 1893 to represent a European firm at the Columbian Exposition. He met H. Lindenberger, and with him formed the company which is now one of the leading independent aluminum refiners. Mr. Lindenberger is still president of the firm. Mr. Wenk is survived by his wife, a daughter, and a son, J. L. Wenk, secretary of the U. S. Reduction Company.

George W. Kuchler

George W. Kuchler, for many years in charge of Peroxygen sales of the Roessler and Hasslacher Chemical Company, now the R. & H. Chemicals Department of E. I. du Pont de Nemours & Co., and widely known in the textile and chemical industries, died of a heart attack on February 10, 1933, at Houston, Texas. He was 69 years old.

George J. Almendinger

George J. Almendinger, president of Buckeye Brass and Manufacturing Company, Cleveland, Ohio, died February 14, 1933, after several months' illness. He was 58 years old.

Mr. Almendinger was born in Germany, and came to this country at 13. He learned pattern making and worked at the trade for some time. He founded and brought the Buckeye company up to its present importance in the brass industry.

James Wallace

James Wallace, for the past 50 years associated with the jewelry manufacturing industry at Providence, R. I., died there on March 13, 1933. He was 80, and had been in poor health for about eight years.

Mr. Wallace was a tool maker with William Smith and Company, Providence, for fifty years. In 1910 he left that firm to join his son in the William A. Wallace Company, also jewelry manufacturers. Some years ago he retired from business due to failing health.

Joseph L. Dinan

Joseph L. Dinan, for many years Pennsylvania representative for Maas and Waldstein Company, Newark, N. J., lacquer manufacturers, died March 19, 1933, aged 64, at Philadelphia. Mr. Dinan was very widely known in the plating industry. He began his career as an orphan of ten with G. T. Sutterly and Company, working first as errand boy, then as plater's helper. He stayed with that firm 33 years, becoming foreman plater and then superintendent of the factory. Then he went to the Celluloid Zapon Company, lacquer manufacturers, in a sales capacity, staying until 1919, when he joined Maas and Waldstein. Mr. Dinan was a charter member of the Philadelphia Branch, American Electroplaters' Society, of which he was the first recording secretary and later the president, and for years a director. He was also an active member of the International Fellowship Club.

Andrew Cameron Pearson

Andrew C. Pearson, board chairman of United Publishers Corporation, New York, died March 31, 1933, aged 60. He was widely known in the industrial publishing business as head of the company which publishes "Iron Age," "Hardware Age," "Automotive Industries," "Jewelers' Circular," and other publications.

Max Lissberger

Max Lissberger, for many years a partner in B. Lissberger and Company, New York, smelters and refiners of nonferrous metals, and until recently an executive of Federated Metals Corporation, which some years ago took over the Lissberger firm, died March 6, 1933. He was 67 years old.

Prosper Clust

Prosper Clust, junior partner in Dieges and Clust, New York City, manufacturing jewelers, died March 28, 1933. He had been ill for two years. Mr. Clust was 59, and had been with Dieges and Clust since 1898.

News of Associations

American Electroplaters' Society

CHICAGO BRANCH AN OLD HAND AT CONVENTIONS

Continuing its series of informative pieces on various subjects of interest to platers, manufacturers and others contemplating attending the 1933 Annual Convention of the American Electroplaters' Society, which takes place June 27-30, inclusive, at Chicago, Ill., the Chicago Branch of the Society, which has charge of the arrangements for the convention has issued a summary of the history of that Branch.

Charles H. Proctor, founder of the Society, organized a meeting of Chicago platers in April, 1912, at which he suggested formation of a Chicago branch of what was then the National Electro-Platers' Association, which he had started in New York. As a result, the Chicago Branch was formed shortly after, with J. H. Hansjosten as chairman, and F. J. Liscomb as secretary. Application for a charter was sent to the national body; in due time it was granted; and at the first regular meeting, held at the Old Briggs House, Chicago, on May 18, 1912, permanent officers were elected, as follows: President, J. H. Hansjosten; vice-president, J. H. Hall; secretary-treasurer, O. E. Servis; board of managers, H. E. Will-

more, W. R. Abbott and John Lackerbie. Twenty-seven charter members were enrolled. (Today the membership has grown to 228.)

In 1913 the national organization was reorganized, and the name changed to American Electroplaters' Society. The city chosen for the first national convention, to be held in 1914, was Chicago. It took place at the Fort Dearborn Hotel.

The Chicago Branch will celebrate its twenty-first birthday by entertaining the whole Society during its twenty-first convention. The progress of the Branch has been the result of intense interest on the part of both the officers it has had and the members. Attendance records for its meetings through the years indicate how well the Branch has performed its functions of both scientific education coupled with pleasant relationship between members of the plating industry.

The Chicago Branch has been an important factor in the Society. Members of it have been honored a number of times by election to office in the Society. J. H. Hansjosten, O. E. Servis and F. J. Hanlon have been presidents; H. A. Gilbertson, Mr. Servis and Mr. Hanlon have been national secretaries; H. E. Willmore and Mr. Hanlon have both been editor of the Monthly Review; Jacob Hay is chairman of the Research Committee. Other members have done work for the whole organization. E. Lamoureau and F. J. Liscomb have assisted at the formation of new branches, besides performing other important tasks.

The Chicago Branch originated the "Question Box" idea, which is now an institution of the Society, and is used at meetings by practically every Branch. A Chicago Branch man was first chairman of the Research Committee, and a Chicago man still heads this most important element in the progress of the Society and electroplating in general. A member of whom the Branch is sproud is Dr. Oliver P. Watts of the University of Wisconsin, who has done much to further the science of plating.

It is apparent, from this, that the Chicago Branch has had a fine record of achievement. The Branch expects to sustain this record, and to add to it, by its handling of the 1933 Convention, which takes place in June, after the opening of the Century of Progress Exposition, so that the visiting platers and friends may visit the World's Fair while attending the convention. That is why we urge all members of the Society and all others interested in plating or finishing to plan now to attend. We reiterate:

You cannot afford to miss the 1933 A. E. S. Convention.

CONVENTION COMMITTEE.

Newark Branch

The program of the educational session of the Newark Branch, A. E. S., is now available. The session will take place at 2:30 P. M., Saturday, April 28, 1933, at Elks Club, Broad Street, Newark, N. J. Besides the session, plant visits have been arranged. In the evening there will be a dance and entertainment, in place of the usual annual banquet. A good show is promised, and some lively music and refreshments. Regarding this the arrangement committee says:

"We could say plenty about our plans to make this a signal event, but we prefer to let those who attend be judge and jury. We are confident that attendance at both session and dance will amply repay the members and guests for coming to Newark."

Educational Program

"Results of Recent Studies of Zinc Anodes," by Dr. A. K. Graham, University of Pennsylvania.

"Electrolytic Refining of Nickel," by O. B. J. Fraser.

"Recent Developments in Electroplating," by George B. Hogaboom, Hanson-Van Winkle-Munning Company, Matawan, N. J.

The above is a partial list of the papers and discussions. All platers, chemists, manufacturers and others interested in plating and finishing are urged to attend.

A. E. S. Research Fund

Contributions to the Research Fund of the A. E. S. for February, 1933, totaled $40. Contributors were:

Wald Mfg. Co., Maysville, Ky., $5; Los Angeles Branch, A. E. S., $10; Tremont Old Colony Plating Co., South Boston, $5; Philip Sievering, Maplewood, N. J., $10; Geo. L. Clafling Co., Providence, R. I., $10.

Manufacturers and platers are urged to support the highly important research work in electroplating which is being carried on by the Fund.

Contributions may be sent to Walter Fraine, Secretary-Treasurer, 507 Grand Avenue, Dayton, Ohio.

Electrochemical Society 63rd Convention

The 63rd annual convention of the Electrochemical Society will be held at the Hotel Windsor, Montreal, Canada, May 11, 12 and 13.

The program for the various sessions includes the following of interest to our readers:

Thursday, May 11, 1933—Session on Aqueous Electrolytes, Mr. H. S. McKnight of the Canadian Copper Refiners, Ltd., Presiding.

Friday, May 12, 1933—Scientific-technical session on Electric Furnace and miscellaneous papers, Prof. Alfred Stansfield of McGill University, Chairman.

Plant trips to the Montreal East Plant of the Canadian Copper Refiners, Ltd., and the Montreal Brewery.

Papers

Among the papers which have been accepted for publication and presentation are:

"Chromium Plating on Zinc," by M. deKay Thompson and F. C. Jelen.

"The Electrodeposition of Ternary Alloys of Cadmium, Zinc and Antimony," by L. E. Stout and Leonard Goldstein.

"American and Canadian Producers of Electrothermic and Electrochemical Products."

"Some New Organic Addition Agents for Cadmium Electroplating," by R. A. Claussen and H. L. Olin.

"Theories of Addition Agent Action," by Robert Taft.

"The Behavior of Platinum, Tantalum and Columbium as Cathodes for Metallic Depositions," by D. F. Calhane and C. Malcolm Alber.

"Cyanide-Free Bath for the Deposition of Copper on Steel," by Colin G. Fink and C. Y. Wong.

"Electroplating of Rhodium," by Colin G. Fink and George C. Lambros.

"Nickel Plating of Fabricated Zinc in a Barrel," by Albert Hirsch.

Exhibit of Electrochemical Products

An exhibition of electrochemical products and apparatus for electrochemical processes will be held in conjunction with the Electrochemical Society Meeting at the Hotel Windsor not far from the registration desk. Those desiring to exhibit should communicate with D. A. Pritchard, P. O. Box 1260, Montreal, Canada.

There will also be a number of social functions, including an excursion to Shawinigan Falls.

Major Meetings in 1933

American Electroplaters' Society, Annual Convention, Congress Hotel, Chicago, Ill., June 27, 28, 29, 30.

American Foundrymen's Association, Annual Convention and Exposition, Stevens Hotel, Chicago, Ill., week of June 19.

The Electrochemical Society, Spring meeting, Hotel Windsor, Montreal, Canada, May 11, 12, 13; Fall meeting, Chicago, Ill., September 7, 8, 9.

American Society for Testing Materials, 1933 Meeting and Second Exhibit of Testing Apparatus, Stevens Hotel, Chicago, Ill., June 26, 27, 28, 29, 30.

National Association of Purchasing Agents. 18th Annual International Convention, Hotel Statler, Boston, Mass., June 12-15.

National Metal Congress and Exposition, Detroit. W. H. Eisenman, Secretary, 7016 Euclid Avenue, Cleveland, Ohio, October 2-6.

United Electroplaters' League

United Electroplaters' League held meetings February 14 and 24, at the Teutonia Rooms, 158 Third Avenue, New York, the regular meeting place. At the first of these meetings a communication from Union Health Center was read, approving of their methods of annual health examination for plater members. It was announced that an effort is to be made to get technical men to give the League lectures on the science of electroplating.

At the second February meeting a program of interest to all platers was discussed. After business, there was discussion of various topics, including chromium plating, anodic treatment of aluminum, nickel plating, low pH nickel solutions, and rhodium plating.

President Kelly was chairman of both meetings. Secretary-treasurer is John E. Sterling, 2581 46th St., Astoria, L. I.

A. H. KOHN, Recording Secretary.

Connecticut Foundrymen

The Connecticut Non-Ferrous Foundrymen's Association met March 13 at the Hotel Garde, New Haven. R. C. Miller of Osborn Manufacturing Company, Cleveland, gave a highly informative talk on Light Machine Moulding Costs, pointing out the effects of these costs on the general cost structure. He offered many suggestions for better control of this item of cost. There was a good attendance and Mr. Miller's ideas were received with great interest.

Through the courtesy of Whitehead Brothers Company, New York, specialists in foundry sand, Walter M. Saunders of Providence, R. I., will address this association on Foundry Sands, at the meeting Monday evening, April 10, at Hotel Garde.

(Secretary of this association is David Tamor, Reading, Pratt and Cady Company, Hartford, Conn.)

LOUIS G. TARANTINO.

National Association of Waste Material Dealers

The National Association of Waste Material Dealers, Inc., headquarters Times Building, Times Square, New York, will hold its 20th annual convention at Sherman Hotel, Chicago, March 13, 14 and 15. The nominating committee has submitted the name of George Birkenstein of S. Birkenstein and Sons, Inc., Chicago, metal dealers, for president for 1933-34. Nominations for directorship include the following metal men: David Feinberg, Boston; E. L. Frankel, Frankel Brothers, Ltd., Toronto; Oscar Spitzer, International Minerals and Metals Corporation, New York; L. J. Messinger, Federated Metals Corporation, New York.

The (nonferrous) Metal Division will meet for round table discussions and conferences on various subjects, such as battery plates; copper smelting; aluminum smelting; classification; metal dealers' problems; metal definitions. Members can thus sit in on any discussions that interest them and omit the others. Papers will be read, including: "Is the Supply of Secondary Metal Drying Up?" by George Birkenstein; "Sources of Supply of Secondary Metal," by B. H. Banks of Nassau Smelting and Refining Company. Chairman Benjamin Friedman of the Metal Division will preside.

Pewter and Hollow Ware Manufacturers' Association

The Pewter and Hollow Ware Manufacturers Association, 11 West 42nd Street, New York, has adopted a resolution approving the minimum wage bill introduced by New York State Senator Albert Wald. A communication was sent to Governor Lehman urging that he sign the bill if passed by the Legislature.

The pewter ware manufacturers stated they have always maintained a fair wage schedule, above any minimum contemplated by the law, and members of the Association agreed that adoption of a minimum scale would benefit industry in New York.

Industrial and Financial News

Aluminum Co. Ordered to Reveal Production Costs

The Aluminum Company of America, Pittsburgh, Pa., was last month ordered by the United States Circuit Court of Appeals at New York to reveal its production costs. The order was issued in proceedings brought by the Baush Machine Tool Company, Springfield, Mass., against the Aluminum Company of America, charging that the latter violated the anti-monopoly laws. The Baush company demanded $9,000,000 in triple damages, and the lower court ordered the Aluminum company to present its production costs as a part of the evidence. Throughout the depression, the price of crude aluminum has been maintained at 23.30 cents a pound.

Film Shows Metals in Motor Car

The story of the present-day motor car is one of metals and alloys that have been developed after years of research. "The Metals of a Motor Car," a new two-reel "silent" educational motion picture film, has been prepared by the Bureau of Mines in cooperation with an automobile company. It shows how metals and alloys are used in a motor car, and visualizes the necessity of using a combination of metals which will withstand heat, wear and shock. The construction of an automobile engine is portrayed. Detailed construction of chassis is shown, together with assembly of axles, steering knuckles, connecting rods, transmission gears, universal joints, differential, and other parts. Attention is directed to precision in use of metals specified by metallurgists in order to provide safe, comfortable and efficient motor cars.

Copies of this film in both the 16-millimeter and 35-millimeter size may be obtained for exhibition by schools, clubs, business organizations and others, from the Pittsburgh Experiment Station, United States Bureau of Mines, Pittsburgh, Pa. No charge is made for use of the film, although the exhibitor is asked to pay transportation charges.

Metallizing Equipment

The Metallizing Engineering Company, 214 Provost Street, Jersey City, N. J., distributors for the Metallizing Company of America, Inc., Los Angeles, have installed metallizing equipment and a complete assortment of machine tools to handle metallizing work on a production basis in their plant in Jersey City. They also have a portable installation to do work in the field.

In addition the Metallizing Engineering Company is starting a Metallizing School on April 10, 1933, which will give a two weeks' intensive course in metallizing, the operation of the equipment, preparation of the surfaces, coating of the various objects, metallurgy and chemistry in connection with metallizing, figuring of costs and salesmanship in connection with metallizing job work.

The class will be limited to 25 and will be in charge of R. A. Axline who will be assisted by L. E. Kunkler and A. J. Weisbecker.

Conference Will Discuss High Accident Costs

The economics of accident prevention will be one of the major topics of discussion at the Ninth Annual Eastern Safety Conference to be held May 4 at Newark, N. J. Metal and supply men who will cooperate include H. O. High of Grasselli Chemical Company, Grasselli, N. J.; N. W. Pierce of Raritan Copper Works, Perth Amboy, N. J.; G. C. Bailey, R & H. Chemicals Division, E. I. du Pont de Nemours & Company, Perth Amboy; L. S. Henwood, Hunt Pen Company, Trenton; H. E. Wright, Westinghouse Lamp Company, Bloomfield, N. J.; C. L. Searles, Western Electric Company, Kearny, N. J.; B. C. Hanson, J. A. Roebling's Sons Company, Trenton.

Doehler Die Casting Company Moves

Doehler Die Casting Company, New York, will center its manufacturing operations and general offices in Toledo, Ohio, according to H. H. Doehler, president. Branch plants will be operated at Pottstown, Pa., and Batavia, N. Y., as heretofore, but manufacturing plant at Brooklyn, N. Y., will be eliminated. The entire executive staff will move to Toledo, and only a sales office will be retained at New York.

Brass Ingot Statistics

On March 1, unfilled orders for brass and bronze ingots and billets on the books of the members of the Non-Ferrous Ingot Metal Institute, Chicago, Ill., amounted to a total of 14,952 net tons, as compared with 15,934 tons on February 1.

The combined deliveries of brass and bronze ingots and billets by the members of the Institute for February, amounted to 1,421 tons, as compared with 1,261 tons for January, 1932.

Average prices per pound received by the Institute members on commercial grades of six principal mixtures of ingot brass during the twenty-eight day period ending March 24, 1933, are as follows, with comparative prices reported for the period ended February 24:

	28 Days Ended	
Commercial 80-10-10	March 24	Feb. 24
(1% Impurities)	6.397c	6.076c
Commercial 78%	4.904c	4.504c
Commercial 81%	4.835c	4.750c
Commercial 83%	5.355c	5.019c
Commercial 85-5-5-5	5.689c	5.293c
Com. No. 1 yellow	4.513c	3.915c

Win Suit on Zinc Pigment

New Jersey Zinc Company, New York, was last month awarded United States Patent No. 1725742 for pigmenting rayon, which patent was issued in 1929 to J. A. Singmaster who assigned it to Tubize Chatillon Corporation. The decree ordered defendants to cease operating under the patent and to give an accounting for profits.

Metal Developments

ZINC. Land reclamation on the seasoast of Holland recently required sinking of a huge zinc raft weighted with basalt.

ALUMINUM. Giant dirigible Macon, sister ship of the Los Angeles, and like it, built largely of aluminum alloys, will soon make its first flight.

ALUMINUM consumption in China during 1932 is estimated at 6,110,000 pounds, of which 4,500,000 pounds was turned into foil, and 1,500,000 pounds into sheet; the remainder was used for castings, chiefly marine and munition.

Business Items—Verified

Aluminum Company of America, Edgewater, N. J., has installed a plating department. O. W. Holcombe is district purchasing agent at Edgewater.

Belke Manufacturing Company, Chicago, Ill., maker of electroplating and polishing equipment and supplies, has moved to new quarters at 947 North Cicero Avenue.

Excel Auto Radiator Company, Chicago, Ill., has removed to larger manufacturing space at 320 East 21st Street. Company operates tool room, stamping, soldering, polishing and grinding departments.

Harnischfeger Corporation, Milwaukee, Wis., has appointed **Florandin Equipment Company,** 40 West 40th Street, New York, as its welder representative in the metropolitan district of New York and northern New Jersey.

John A. Eckman has been re-elected president of the **Jamestown Metal Desk Company, Inc.,** Jamestown, N. Y. Other officers chosen were **Emil J. Jones,** vice-president and general manager, and **John A. Jones,** secretary and treasurer.

Harrison Sales Company, Seattle, Wash., distributors of the Barber-Colman electric system of temperature control in Washington and Oregon, announce the appointment of a representative in Portland, Ore., to handle this line.

Ritter Dental Manufacturing Company, Rochester, N. Y., is operating at 65% of capacity, according to E. L. Wayman, president, it is reported. Tool and design departments are at 100%. A $50,000 order was booked last month from one university.

Altoona Nickel and Copper Plating Works, whose plant at 2207 Union Avenue, Altoona, Pa., recently was partly destroyed by fire, has removed to 2415 Union Avenue (rear), and is operating again. Firm is in the market for polishing and plating supplies. R. E. Jones is the proprietor.

E. F. Houghton & Co., Philadelphia, Pa., has taken over the manufacture and sale of chemical products formerly made by **Weaver Bros Co.,** Cleveland. **J. C. Weaver,** formerly vice-president of the Weaver company, is now manager of the cleaner and pickling products department of Houghton.

Oscar A. Lenna was re-elected president and general manager of Jamestown Metal Equipment Company, Inc., Jamestown, N. Y., makers of automobile radiators and interior metal equipment. **H. L. Briggs** and **G. A. Lawson** are vice-presidents; **H. A. Lenna,** secretary-treasurer; **R. W. Alden,** assistant secretary-treasurer.

Crucible Steel Company of America, 405 Lexington Avenue, New York, has acquired **Copperbond Steel Products Company,** New York, together with all patent rights to a process for reducing copper-covered steel wire. The new unit will be operated as the Crucible Copperbond Division, under the direction of **William McIlvane,** formerly central station manager for Bridgeport Brass Company.

Benedict Manufacturing Company, Syracuse, N. Y., recently displayed a large exhibit of its products, hollow ware and other plated goods, silver, pewter and copper articles, soda fountain equipment, etc., at a Syracuse bank, in connection with a "Made in Syracuse" exhibition. The Benedict company operates tool room, casting shop, stamping, tinning, soldering, plating, polishing and lacquering departments. The purchasing agent is W. J. Hanlon.

Bullard Company, Bridgeport, Conn., elected directors March 15, as follows: E. P. Bullard, E. C. Bullard, D. B. Bullard, J. W. Bray, A. E. North, E. P. Blanchard, H. C. Bullard, J. W. C. Bullard, and T. E. Dunn. At the ensuing meeting of the board, the following officers were elected: E. P. Bullard, president; E. C. Bullard, D. B. Bullard, J. W. Bray, vice-presidents; A. E. North, secretary-treasurer; G. L. Todd, assistant secretary-treasurer.

B. F. Goodrich Rubber Company, Akron, Ohio, has appointed **Lucien Q. Moffitt, Inc.,** Peoples Bank Building, Akron, Ohio, exclusive distributors for Goodrich Cutless Rubber bearings in the United States and Canada. The move is to insure concentrated and specialized sales and engineering service to dealers and users. L. Q. Moffitt has headed the Goodrich rubber bearing department since the cutless bearing was developed, and will retain the personnel of that department in the new company.

New Corporations

Forestek Plating and Manufacturing Company, Cleveland, Ohio; to manufacture and plate metal goods, electrical appliances, etc., taking over Forestek Plating Company, 9607 Quincy Street; by Samuel and Victor Forestek.

R. J. Schwab Sons Company, Milwaukee, Wis.; to manufacture heating, air conditioning, filtering equipment, etc.; plant and offices opened at 605 South First Street; by H. E. Schwab and associates.

Morganstern Electric Company, Inc., Pittsburgh, Pa.; to operate plant for manufacture of electrical machine products, etc.; E. B. Strassburger, Grant Building, representative.

Chautauqua Metalcraft Company, 15 Ellis Avenue, Jamestown, N. Y.; to manufacture metal products; by Dale W. Kahle and associates.

New England Metal Coating Company, 116 Elm Street, Providence, R. I.; to do molten metal spraying; by J. A. and C. A. Gustafson and W. H. and W. N. Simpson.

Corporation Reports

Corporations reported profits or losses for the fiscal year 1932 as follows. Comparative 1931 figures in parentheses:

Profits

Aluminum Goods Manufacturing Company, Manitowoc, Wis.: $107,705 (profit $906,226).

Falconbridge Nickel Co., Montreal, Que.: $762,421 (profit $10,531).

General Electric Company, Schenectady, N. Y.: $14,404,110 (profit $40,956,996).

Union Carbide and Carbon Corporation, New York: $8,781,426 (profit $18,029,522).

Waltham Watch Co., Waltham, Mass., $259,415 (deficit $579,950).

Western Electric Co., New York, $12,625,972 (profit $10,816,387).

Losses

Aluminum Industries, Inc., St. Cloud, Minn.: $70,889 (profit $134,142).

American Machine & Metals, Inc., $169,798 (profit $47,015).

Art Metal Construction Co., Jamestown, N. Y.: $430,238 (loss $558,712).

Bohn Aluminum & Brass, Inc., Detroit, Mich.: $720,568 (profit $295,333).

Doehler Die Casting Co., New York: $98,497 (profit $139,113).

Gorham, Inc., New York: $1,100,000 loss for year ended Jan. 31 ($1,316,310 loss previous fiscal year).

International Nickel Co., New York: $135,344 (profit $4,752,135).

McCord Radiator & Mfg. Co., Detroit, Mich., $649,109 (loss $283,948).

National Cash Register Co., Dayton, O.: $3,399,265 (profit $824,339).

National Enameling & Stamping Co., Milwaukee, Wis.: $439,321 (loss $764,196).

Phelps Dodge Corp., New York: $3,752,252 (loss $988,478).

Pyrene Mfg. Co., Newark, N. J.: $179,627 (loss $132,121).

Revere Copper & Brass, Inc., New York: $2,933,923 (loss $2,811,941).

Yale and Towne Manufacturing Company, Stamford, Conn.: $780,222 (loss $726,250).

News From Metal Industry Correspondents

New England States

Waterbury, Connecticut

APRIL 1, 1933.

Local industries paid all their help during the banking holiday with checks in denominations of $1, $2, $5 and $10. With few exceptions they were cashed by all local business places. The banks allowed industries to withdraw certain amounts of cash for payrolls, so part currency was given in some instances. The banks also made arrangements to cash 10% of the payroll checks received by merchants each day. In most cases, only one week's payroll had to be met this way. All the banks in the city, and all but one of the banks in the state, were opened either the day after the holiday or within a few days thereafter.

Business has positively improved since the banking holiday. Local banks have received over $200,000 in gold and gold certificates as a result of the anti-hoarding action. **Waterbury Manufacturing Company**, subsidiary of the **Chase Companies**, has an order for several hundred thousand vases from a large mail order house, and a large order for lamp bases.

French Manufacturing Company, subsidiary of **American Brass Company**, received by telephone for immediate fulfillment, from a middle western company, the largest order of tubing it has had for a long time. It is now working Fridays for the first time in many months.

William M. Harris, director of the Mutual Aid Unemployment Relief, reports that for the first time in over a year a number of men have left his payroll to go back to work in factories. Receipts of the relief fund, based on wages received by those employed and the contributions from the companies, have mounted considerably, showing that the payrolls of the factories are much higher. Many factories are increasing the number of hours worked weekly. Some which recently had been down to 16 hours a week and are now working an average of 30 to 40.

It is reported that a certain number of departments of the **Scovill Manufacturing Company** are working nights. The Scovill annual report shows a net loss of $1,322,932 for 1932, compared with net profit of $152,912 for 1931, and $506,618 for 1930. The cash position is still strong; $940,274 was charged off for 1932 depreciation; there is a surplus of $2,418,185; capital assets are $440,824,644, which includes over $4,000,000 in cash and $685,784 in government securities. Land, buildings, machinery and equipment are set at $39,936,000. The reserve for depreciation and replacement of $21,914,000 brings the net amount down to $18,021,000. Patents and goodwill are carried at $1, but the goodwill of **A. Schrader Sons, Inc.**, acquired several years ago, is carried at $7,439,749. The company paid out $65,000 during the year for unemployment relief. The regular dividend of 25 cents a share on Scovill stock has been declared, payable April 1.

W. Harold Dowd, exhibit manager of **American Brass Company**, has been loaned to the **Copper & Brass Research Association** to set up the exhibits of the association at the Chicago World's fair. American Brass has already shipped several carloads of material for the exhibit. **Chase Companies** and **Scovill Manufacturing Company** will also have exhibits. Bertram B. Caddle, secretary of the Research Association, says whatever credit the association receives for the exhibit will be due mainly to Mr. Dowd, who is considered one of the best authorities and designers for exhibits in the country.

The local union metal trades workers have protested against the regular post office employes setting up the metal furniture in the new post office now being completed here. W. R. B.

Connecticut Notes

APRIL 1, 1933.

NEW BRITAIN—Local factories paid its employes part cash and part checks during the banking holiday. **Stanley Works** later cashed some of the checks for the employes, and **American Hardware Company** paid entirely in cash on its second pay day during the holiday.

Stanley Works declared a quarterly dividend of 25 cents a share, payable April 1.

Charles Parsons, vice-president of **American Hardware Corporation** and general manager of the P. & F. Corbin division, completed his 40th year with the company last month.

Stockholders of the **Hart, Cooley, Highton Company** have authorized issuance of 2,000 6% preferred shares at $100. The company has a common stock outstanding of $1,000,000 par value.

New Britain Machine Company had an operating loss of $234,032 last year. **President Herbert H. Pease** says the company is in a strong position to withstand further inroads if the depression continues, as new design and development work have been carried on, bringing to completion several machines of greater productive capacity.

Sherwood H. Raymond, 46, head of the rate, cost and pay departments of **Landers, Frary & Clark**, dropped dead at his work February 28.

HARTFORD—**Arrow-Hart & Hageman Electric Company**, reported an operating loss of $169,624 for 1932, compared with profit of $312,352 for 1931.

Veeder-Root Company is making counting and computing mechanisms for gasoline pumps which measure and show the price of the product sold. The company has received a large order from the Wayne Company, Fort Wayne, Ind., manufacturers of gasoline pumps.

Royal Typewriter Company reports a net loss of $423,668 for 1932 after depreciation, taxes and other charges, compared with a net profit of $359,042 th previous year.

Underwood Elliott Fisher Company stockholders last month voted to change the stated value of the no par common shares from $5 to $10. Patents and good will have been written down from $8,812,975 to $1 and the reserve for contingencies has been increased from $5,500,000 to $7,159,800.

Colt's Patent Fire Arms Manufacturing Company paid the regular quarterly dividend of 25 cents a share March 31.

MERIDEN—**International Silver Company** reported net loss of $1,567,238 after all deductions for 1932, compared with a net loss of $1,464,906 the previous year. The company is omitting payment of dividends on its preferred stock due this month.

BRISTOL—Officers and directors of **Bristol Brass Company** were elected last month as follows: president, Alexander Harper; vice-president and treasurer,

Albert D. Wilson; vice-president, Charles T. Treadway; secretary, Harry N. Law; assistant treasurer, Carl A. Gustafson; superintendent John H. Vickers.

The company operated at a loss of $120,523 last year, after reserves and depreciation had been set up. The surplus was reduced from $754,887 to $616,959. Total assets are $2,379,169. The company paid the regular dividend of $1.75 on the preferred stock April 1.

Officers of the **American Silver Corporation** were elected last month as follows: president, treasurer and general manager, Alexander Harper; vice-presidents, Dean Welch and Harry H. Arens; secretary, George M. Merriman; assistant treasurer, John Kaicher; assistant secretary, Caroline B. Holt.

The American Silver plant has been closed for an indefinite period, but officials express belief that it will be reopened soon, when more orders are received. It has been employing about 200 persons for two or three days a week.

Pierce N. Welch has retired as a director of the **American Silver Corporation** and **Bristol Brass Company.**

NEW HAVEN—New Haven Clock Company reports net loss of $629,655 for 1932, compared with net loss of $483,957 the previous year.

Marlin-Rockwell Corporation declared a special dividend of 25 cents a share on the common stock, payable April 1.

BRIDGEPORT—Bullard Company reports net operating loss of $615,421 for 1932, compared with $369,421 the previous year.

TORRINGTON—Torrington Company declared its regular dividend of 50 cents a share, payable April 1.

WINSTED—Officers of **William L. Gilbert Clock Company** report the company is rushed with orders. Hours of operation have been extended, and many of the old hands called back. The concern went into receivership a few months ago. New sales executives were engaged, and since then large orders have been secured.

STAMFORD—Yale and Towne Manufacturing Company declared a dividend of 15 cents a share, payable April 1.

GREENWICH—Electrolux, Inc., has opened a branch factory here employing 150 workmen.

NAUGATUCK—Thomas F. Butterfield, who recently resigned as vice-president and secretary of **Watertown Manufacturing Company,** makers of moulded products, has started a similar business here under the name of **T. F. Butterfield, Inc.,** operating in the building formerly used by the Dunham Mills, Inc. The incorporators include himself, William F. Gager, attorney, Irene Verzina and Marguerite Benjamin of Waterbury. The firm is capitalized at $100,000, divided into 1,000 shares.

WATERTOWN—Watertown Manufacturing Company has increased its schedule from four to five days a week, and now has over 100 employes. **Seymour Smith and Sons Company** also reports an increase in business during the past month. W. R. B.

Providence, Rhode Island

APRIL 1, 1933.

Possibilities for providing part-time employment for twenty thousand persons in Rhode Island are foreseen by the State-wide committee on share-the-work and industrial rehabilitation, whose plans were completed during the past month, according to announcements made by the New Engand Council.

A systematic effort will be made by a committee to solicit co-operation of all Rhode Island employers. Among those in charge of the campaign are: **Edmund C. Mayo,** president of **Gorham Manufacturing Company,** chairman of the Industrial Rehabilitation Division; **Henry D. Sharpe,** president of the **Brown & Sharpe Manufacturing Company. Clemence J. France,** director of industrial division of Providence Chamber of Commerce, is vice-chairman of the Share-the-Work Division.

New England Metal Coating Company has been established at 116 Elm Street by John A. and Clarence A. Gustafson, Willard H. and Willard N. Simpson, with whom Andrew W. Anderson is associated as sales engineer.

Sentry Manufacturing Company, Inc., Providence, has been incorporated to manufacture metal products; with 100 shares common, no par; by F. A. O'Donnell of 163 Lockwood Street, Providence; Frank St. Angelo and G. A. Irons.

Rhode Island Metal Company, 155 Main Street, Pawtucket, is owned by Henry W. Bartlett.

A bill is pending in the Rhode Island General Assembly which would require employers to post notices two weeks in advance of any wage reductions.

Nathan Resnick has severed his connection with **Sherman Manufacturing Company,** manufacturing jewelers, 74 Clifford Street, after eight years as secretary and treasurer.

Louis Grabow is owner of **Machine Products and Novelty Company,** 25 Calender Street.

Calvin Dean, president of **Calvin Dean, Inc.,** 222 Richmond Street, the oldest and one of the largest jewelry findings concerns in the city, died March 2 at his home in Edgewood. He was 74, and had been in ill health for several years. Born in Myricks, Mass., Dec. 25, 1859, he came to Providence as a youth and learned the trade of a jewelry chaser. About forty years ago he opened a small shop which gradually developed into the present business. During his entire career Mr. Dean never had a business partner and when the concern was incorporated in 1927 he became the president.

Metal Cast Novelties Manufacturing Company, 191 Amherst Street, is owned by Omer St. Laurient and Ludger Lapointe.

Aurora Jewelry Company has been incorporated to manufacture jewelry in Providence; with 500 shares common, no par; by Arthur H. Feiner, Alfred G. Chaffee and James Harris.

Maurice Robinson, Charles M. Robinson and Joseph I. Adelson are incorporators of **Rhode Island Ring Company, Inc.;** to manufacture jewelry, with 100 shares common, no par value.

H & H Screw Products Company is erecting a new office building at its plant corner of Mineral Spring Avenue and Smithfield Road, North Providence.

Paul A. Willemin, one of the most expert die cutters for jewelry and silverware purposes in this country, died at his home here March 2, aged 70 years. In his shop at 195 Eddy Street were designed and cut, dies that were used in some of the most noted silversmithing ever produced in America. He came to Providence 56 years ago from Paris, France, where he was born.—W. H. M.

Western Massachusetts

SPRINGFIELD, APRIL 1, 1933.

While comparatively quiet until within the last week, the metal trades have picked up decidedly, and indications are that increased orders which have been coming in gradually will keep western Massachusetts companies busy for some time.

Business at the **Rolls-Royce** plant, which was expected in many quarters to be rather dull this year, is reported picking up, and many old employes have been called back. According to officials, orders are more numerous than they have been for some time, and there appears to be little to worry about as far as the local plant is concerned.

United American Bosch has had a decided increase in inquiries concerning products, and orders have increased appreciably over the past few months.

Westfield Specialties reports that while business is not what might be termed exceptionally good, orders are coming in, and plant officials feel that in the near future business will be such that it may be called good.

The machine tool industry in Springfield has been picking up decidedly, and leaders in these lines are sure that within a few weeks their orders will be greater than at any time in several months. Workers at both the **Bosch Machine Tool Company** and the **Van Norman Company** are comparatively busy, and the prospects appear to be encouraging.

Business at the **Cheney-Bigelow** wire works has turned upward somewhat during the past few months, and the consensus is that within the next few months there will be a decided increase.

Unfilled orders at the local electrical appliance factories are piling up, and with the increase in confidence which is felt in the new political administration, leaders in electrical lines feel that there will be a real upturn in the business before the first of July.

In general the business outlook in this section of the state is decidedly optimistic, and while plant officials do not expect orders in truckloads, they are confident the upturn in volume of trade is near at hand. G. B. Y.

Middle Atlantic States

Newark, New Jersey

APRIL 1, 1933.

Atlas Specialty Company, maker of electrical equipment, has leased a portion of the plant of the Clark Thread Company, East Newark, and will make extensive alterations.

United Radio and Electric Company, Inc., has leased a 5,000 sq. ft. loft on High Street, and will manufacture electric and radio parts.

Application for a receiver for the **Hope Foundry and Machine Company,** Maplewood, N. J., has been dismissed.

Ace Metal Products Company, manufacturing metal products, has been incorporated with $125,000 capital to operate in Newark. C. A. L.

Trenton, New Jersey

APRIL 1, 1933.

Some of the metal plants in Trenton report a slight increase in business during the past month, while others find no change. Manufacturers, however, believe there will be an increase in business by early spring.

Walter Gilby Alloy Company, Newark, has incorporated with $50,000 preferred, $74,000 Class A common, and $1,000 Class B common stock, to manufacture wire products. **Walter Gilby,** Newark, is president. C. A. L.

Central New York

APRIL 1, 1933.

Operations have been resumed in the former plant of the **Grand Chromium Plating Company,** 1900 Bleecker Street, Utica, which has been purchased by **Luis Lilienthal,** New York, president of a new company, **Advanced Chromium Plating Company,** according to the announcement of George L. Brunner of Brunner Manufacturing Company, who is chairman of the Utica Chamber of Commerce committee on industrial development. The plant has been idle since the Grand Chromium Company suspended operations within the past year, that company having moved to Utica from Brooklyn about three years ago. Mr. Lilienthal plans to install new equipment. The company is engaging in chromium plating and metal polishing. Louis V. Howell, formerly with the Grand Company, will be plant manager.

Charles Millar & Son Company, Utica, will furnish pipe to be used in the interceptor sewer being built in East Utica. This concern sells considerable quantities of lead pipe in the Central New York area.

Pierrepont Noyes, Sherrill, head of the **Oneida Community, Ltd.,** is reported to have a ten thousand piece jigsaw puzzle.

Horrocks Ibbotson Company, makers of fishing tackle, have put their full force of 250 persons back to work in anticipation of the spring rush.

Reports of a slight pick-up were given in the Rome non-ferrous manufacturing territory immediately after the bank holiday.

A slight increase in the number of persons employed in the metal factories in Utica was reported during the past month.

On the same factory site where the first writing machine went into manufacture 60 years ago, the eight millionth modernized version was taken off the production line by **James H. Rand, Jr.,** chairman of **Remington Rand, Inc.,** Ilion, N. Y. The typewriter, with an inscription commemorating the anniversary, will be presented to the Y.W.C.A., the organization which first recognized that the typewriter would open the business world to women, and started typing classes to fit them for the opportunity. More than 250,000 Y.W.C.A. members observed the 60th anniversary of the invention at dinners in 500 branches the week of Mar. 27. The "writing machine" was invented by Christopher Latham Sholes, newspaperman and printer. At that time less than one per cent of the employed women of the country were in business. The federal census in 1930 revealed 775,000 of the 10 million employed women were typists and stenographers. E. K. B.

Middle Western States

Detroit, Michigan

APRIL 1, 1933.

Manufacturing in the Michigan area suffered an alarming set-back the past four weeks. Everything was set for opening an aggressive spring campaign, especially in the metal field, when suddenly came the banking holiday and the closing of two main banking institutions in Detroit.

For four or five weeks checking facilities were unavailable and they are still far from normal. Great losses have followed, and business is almost at a standstill.

Upwards of 300 small banks in the state had reserve deposits in the two big banks that collapsed. Although attempts were made to have these reserves considered trust funds, the conservators now insist they have the same status as individual deposits. It is easy to see what this means to the smaller banks.

The automobile plants, which resumed so auspiciously a few weeks ago, now must start all over again. A few have resumed on reduced production schedules, while others are doing practically nothing. Accessory plants likewise have slowed up or discontinued operations. Plating plants are following practically the same program.

Until financial conditions are adjusted and the public resumes motor car buying little is expected in the metal industries in the Michigan area.

Manufacturers of plumbers' and steamfitters' supplies are dragging along. Production continues about the same as during the winter, and nothing particularly outstanding seems to be in sight. Manufacturing jewelers have almost ceased production.

Consolidated Stamping Company, 2755 West Fort Street, Detroit, was recently granted an exclusive franchise by **Aluminum Colors, Inc.,** Indianapolis, for anodic treating of all types of aluminum castings, stampings, strips and sheets by a newly developed process which now makes aluminum highly resistant to all kinds of corrosive action. The colorless anodic bath imparts a soft, silvery sheen to the surface. It is predicted that motor car manufacturers will make use of this process in the near future. Complete "Alumilite" equipment and other facilities already have been installed by Consolidated to handle jobbing and manufacturing contracts for the entire state.

United Stove Company, Ypsilanti, has started production on 10,000 "Sav-Oil" cook stoves.

Active Pattern and Foundry Company, has been incorporated at Detroit, and is engaged in manufacturing metal as well as wood patterns. **Henry R. Fangmeyer,** 534 East Fort Street, is principal stockholder.

Between 400 and 500 employes of the **Kelvinator Corporation,** Detroit, laid off because of the banking holiday, have been recalled to work, says **G. M. Evans,** vice-president in charge of manufacturing.

A new electric refrigerator by **Copeland Products, Inc.,** Mt. Clemens, Mich., has been announced by **W. D. McElhinny,** sales vice-president. The complete system, it is stated, weighs only 74 pounds, about half as much as the conventional type; uses 5½ ounces of refrigerant as against approximately 19 ounces in the older types.

The entire production crew of the foundry operated at Saginaw, Mich., by **Chevrolet Motor Car Company,** numbering more than 3,500, has returned to work after a week's layoff that resulted from the banking holiday. This plant produces engine blocks for all Chevrolet and Pontiac motor cars.

A full force of 1,400 men has been called back by **Graham-Paige Motors Corporation,** Detroit. This marks the resumption of its spring schedule.

F. J. H.

Cleveland, Ohio

APRIL 1, 1933.

Although Cleveland has been under a financial strain for three or four weeks, some heartening announcements were made as March drew to an end. Industrial concerns are now beginning to open and those on curtailed schedules are resuming along more substantial lines. The motor car and accessory plants are making strenuous efforts to revive.

Nevertheless, everyone is finding it difficult to overcome the handicap that resulted from the banking holiday. It is believed, however, from now on industry of all kinds will continue gradually to improve. Motor car production probably will drag some, but it will probably advance as the season progresses. Production of electrical equipment should make a substantial showing in April. Reports from surrounding industrial areas are more or less encouraging as the banking situation is slowly being ironed out and confidence returns.

The plating business is creeping upward, although conditions are not all that they should be at this season of the year.

Fisher Body Company's branch plant here has resumed on increased production. More than 3,000 former employes have been recalled. **L. R. Scafe,** general manager, said last week he expects the plant will soon be operating almost at normal.

Chevrolet branch plant at Toledo has resumed operations. For a week or more it had been almost closed.

A possible increase in lake shipping this summer over last is indicated by the early posting of notices for engineers to report at Cleveland for outfitting vessels of the Pittsburgh Steamship Company.

F. J. H.

Chicago, Illinois

APRIL 1, 1933.

Unsettled conditions continue to hold up any significant upturn in the metal industries. In addition, curtailment of purchasing during the banking holiday, resulted in lack of activity in automobile, farm equipment and other manufacturing lines. Indications the past few days, based chiefly upon general business, point to a spring upturn.

George A. Ranney has resigned as vice-president of the **International Harvester Company,** to become vice-chairman of three Chicago utility companies, Commonwealth Edison Company, Peoples' Gas Light and Coke Company, and Public Service Company of Northern Illinois. **M. F. Holahan,** heretofore manager of domestic sales, was elected a vice-president in charge of sales.

W. J. Boone, for more than four years president and general manager of the **Stutz** Chicago factory branch, has resigned to enter the retail automobile business.

Trane Company has appointed **Jerry Mannion,** former sales manager of the **Chicago Pump Company,** to management of air conditioning sales in the Chicago area.

Motor Equipment Manufacturers' Association is planning a National Automotive Exposition in the Merchandise Mart, October 23 to 28, featuring new products for automobile servicing.

Don M. Compton, general manager, treasurer, vice-president, and a director of **Grigsby-Grunow Company,** has resigned from the company. **Le Roi J. Williams** has been elected vice-president and general manager, and **M. D. Harrison** treasurer. **T. J. Williams,** formerly assistant to the president, has been named executive assistant to the president. **W. G. Peirce, Jr.,** formerly assistant vice-president in charge of radio for Grigsby-Grunow, has resigned to become an executive with **Peirce-Phelps, Inc.,** Philadelphia.

William C. Grunow, head of Grigsby-Grunow; **H. C. Bonfig,** sales manager; **Dr. J. D. Gordon,** physicist and engineer; and **J. H. Davis,** sales promotional engineer, spoke at the initial Chicago showing of the new Grunow refrigerators, which was attended by 500 dealers of the Northern Illinois division.

Carl W. Priesing, formerly general sales manager for the **Wahl Company,** is now vice-president in charge of sales.

Henry S. Beal, president of the **National Machine Tool Builders' Association,** has been elected president of the **Sullivan Machinery Company.**

Recent incorporations include: **Frost Electric Screen Company of Illinois,** Girard, Ill.; to manufacture electric insect destroyers; $50,000 preferred. **B. C. Company,** 82 West Washington Street, Chicago; $40,000 common; manufacture laundry equipment. **Aero-Whirl Plane, Inc.,** 11 South La Salle Street, Chicago; flying machines, apparatus, etc. **Metalcraft Corporation,** 361 West Superior Street, Chicago; lamp shades.—R. G. K.

Metal Market Review

APRIL 1, 1933.

Practically all of the metals showed a buoyant tendency early in the month, largely as a result of expectations of currency inflation. Prices went up sharply the second week of the month, only to recede again as the month progressed. The banking holiday interrupted trading, but immediately after it the rise in prices started, and the consumers showed the usual willingness to take metal on the ascending market. On the other hand, producers were none too eager to let metal go at the levels that prevailed, especially not for forward delivery. Prompt delivery was easily obtainable, and still is.

Copper

After having held at 5c. delivered Connecticut for some months, electrolytic copper began to rise on March 8, and thereafter went up steadily until on the 13th it was 5.75c. A decline set in after a few days, and by the end of the month the price was again 5c. Sellers at the month-end were not inclined to offer metal for future delivery at 5c., however, but prompt metal was plentiful. There was no great demand from consumers, who are well aware of the large surplus stocks in producers' hands.

Lead

The lead producers advanced prices twice during the second week of March. It reached 3.22½c., St. Louis, on March 10, hung there until March 21, when it went down to 3.12½c. Further reductions on March 22 and 23 brought the price down to 2.87½c. where it held at the close, making the net gain for the month zero.

Sales were heavy the early part of the month, amounting to 11,000 tons in one week, which was the best one week in June, 1931. The total business for March shipment amounted to something over 20,000 tons, it was reported, compared with 13,000 for February. Bookings for April shipment had reached about 18,000 tons on March 29.

Zinc

Zince prices took the same trend as lead, moving upward early in the month, but receding again, although the 2.95c St. Louis price at the end of March was 20 points above the level at the beginning of the month. The price went as high as 3.15c. on March 15, and held there until the 23rd before the decline set in. The statistical position has not improved, stocks at the end of February having been larger than the month previous.

Tin

The banking holiday affected tin severely, practically all trading having been suspended, although nominal prices strengthened along with the other metals. The absence of a sterling exchange price was the chief obstacle to business. The price at the beginning of March was 23.50c. N. Y., for Straits. It went as high as 25.50c. March 8, and thereafter fluctuated considerably, ending the month at well above 24.50c., which was a gain of 1c. on the month. Consumer demand for the metal remains unexciting.

Other Metals

Aluminum—The price of aluminum remained unchanged at 23.30c. per pound for 99 per cent plus commercial and mill ingot. The aluminum business has been holding its own very well, as compared with the other metals, but consumption on the whole is restricted in line with the generally slow rate of industrial activity. Aluminum is sharing in the business which has developed out of the legalization of beer.

Antimony—Antimony prices strengthened after the banking holiday ended, and stayed at 6.25c. for Chinese 99 per cent for a while. About mid-month it declined to 5.95c., where it remained

through the end of the month, with slight fluctuations in transactions on the market. The United States Commerce Department was advised by its agent at Shanghai that the Chinese government is expected to discontinue its efforts to maintain the monopoly it initiated.

Precious Metals—Silver took an upward leap after the banking holiday, and touched 30c. on March 8. It went downward thereafter, and ended the month with the New York official price at 27.25c. Trading was suspended March 6, in accordance with the presidential proclamation, but Handy and Harmon, New York, continued to quote an official price to provide a basis for settling transactions covering silver used in arts and industries. Trading was resumed March 13.

Secretary of the Treasury Woodin announced that restrictions on dealings in gold would not be permitted to interfere with its normal use in the industrial arts.

Platinum went up to $30 immediately after the banking holiday was declared. After a few days it was down again to $24, at which point it held from March 13 to the end of the month. Cash transactions between dealers were reported at several dollars below that level.

Scrap metals—Prices tended to follow the markets for new material. Early in the month the list strengthened; later it declined again. Demand was in line with the price trend, increasing on the ascent of prices and falling off as prices went down. Scrap is not being pressed for sale by the trade. Brass and aluminum ingots are in no heavy demand.

The Wrought Metal Market

APRIL 1, 1933.

Prices of copper and brass products were changed twice during the past month. On March 9 the leading producers of brass mill products advanced their quotations ½c. throughout the list, in line with the stronger copper price, excepting only welding rods, rivets and burs, which had not been lowered in the general reduction on March 1. Extruded copper and nickel silver shapes, which a week earlier had been reduced ¾c., were advanced the ½c. on March 9, leaving them actually ¼c. below the prices which prevailed before March 1. On March 14 there was a further advance of ¼c. on all products, again excepting welding rods, rivets and burs. This put the general level of the brass mill products list ½c. to ¾c. above the record low for all time, which had been established March 1. The prices with latest revision are shown on the opposite page.

The general business outlook during March was improved, despite the financial crisis early in the month. Several factors had a very good influence on the wrought metal business, chief of which were the stronger tone of the raw metal markets and the passage of legislation permitting the manufacture of beer. The brewing industry, as well as the places dispensing its products, have always required a large amount of metal products, and already some good business has been booked by suppliers of copper sheet, brass products, nickel alloy materials of several kinds, aluminum and other nonferrous products.

Reports from several parts of the country indicate an increase in metal manufacturing plant activities. Consumption of fabricated and semi-finished material is therefore expected to expand considerably during the coming months. Manufacturing plants in the Connecticut Valley and other sections of New England, and in the Middle West were increasing schedules, and these are the large users of metals.

Nickel sales have increased in recent months, according to R. C. Stanley, president of International Nickel Company. This is no doubt due to the company's constant interest in development of new uses for the metal and its alloys.

The Aluminum Company of America is another example of a company which is actively expanding the uses of its products.

There will be an excellent exhibit of copper and brass products at the Century of Progress Exposition at Chicago this year. This is being installed by the Copper & Brass Research Association, which has already shipped large quantities of material for the exhibit.

Daily Metal Prices for March, 1933

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	2	3	*6	7	8	9	10	13	14	15	16	17
Copper c/lb. Duty 4c/lb.													
Lake (Del.)	4.90	4.90	4.90	....	4.90	5.25	5.50	5.50	5.75	5.75	5.75	5.75	5.50
Electrolytic (Conn.)	5.00	5.00	5.00	....	5.00	5.25	5.50	5.50	5.75	5.75	5.625	5.625	5.50
Casting (f.o.b. ref.)	4.75	4.75	4.75	....	4.75	5.00	5.25	5.25	5.50	5.50	5.50	5.50	5.25
Zinc (f.o.b. St. L.) c/lb. Duty 1¼c/lb.													
Prime Western	2.70	2.70	2.70	....	2.75	2.85	3.00	3.10	3.15	3.20	3.15	3.15	3.15
Brass Special	2.75	2.75	2.75	....	2.80	2.90	3.05	3.15	3.20	3.25	3.20	3.20	3.20
Tin (f.o.b. N. Y.) c/lb. Duty Free													
Straits	23.50	23.65	23.75	....	24.50	25.50	25.50	25.50	24.00	24.20	24.35	24.50	24.35
Pig 99%	22.30	22.40	22.50	....	23.50	24.50	24.50	24.50	22.70	22.875	23.00	23.125	23.00
Lead (f.o.b. St. L.) c/lb. Duty 2½c/lb.	2.875	2.875	2.875	..	2.875	3.125	3.125	3.225	3.225	3.225	3.225	3.225	3.225
Aluminum c/lb. Duty 4c/lb.	23.30	23.30	23.30	....	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30
Nickel c/lb. Duty 3c/lb.													
Electrolytic 99.9%	35	35	35	....	35	35	35	35	35	35	35	35	35
Shot (from remelted electrolytic)	36	36	36	....	36	36	36	36	36	36	36	36	36
Pellets 99.5-100%	40	40	40	....	40	40	40	40	40	40	40	40	40
Antimony (Ch. 99%) c/lb. Duty 2c/lb.	5.75	5.75	5.75	....	5.75	6.00	6.25	6.25	6.25	6.00	5.95	5.95	5.95
Silver c/oz. Troy Duty Free	26.50	26.625	27.25	....	29.50	29.375	30.00	29.75	27.75	27.50	27.50	28.25	28.00
Platinum $/oz. Troy Duty Free	20.50	20.50	20.50	....	20.50	30.00	30.00	30.00	24.00	24.00	24.00	24.00	24.00

	20	21	22	23	24	27	28	29	30	31	High	Low	Aver.
Copper c/lb. Duty 4c/lb.													
Lake (Del.)	5.25	5.25	5.25	5.125	5.00	5.00	5.00	5.00	5.00	5.00	5.75	4.90	5.238
Electrolytic (Conn.)	5.25	5.25	5.25	5.125	5.00	5.00	5.00	5.00	5.00	5.00	5.75	5.00	5.244
Casting (f.o.b. ref.)	5.00	5.00	5.00	4.875	4.75	4.75	4.75	4.75	4.75	4.75	5.50	4.75	5.006
Zinc (f.o.b. St. L.) c/lb. Duty 1¼c/lb.													
Prime Western	3.15	3.15	3.15	3.10	3.10	3.00	3.00	2.95	2.95	2.95	3.20	2.70	3.005
Brass Special	3.20	3.20	3.20	3.15	3.15	3.05	3.05	3.00	3.00	3.00	3.25	2.75	3.055
Tin (f.o.b. N. Y.) c/lb. Duty Free													
Straits	24.00	23.875	23.90	24.20	24.50	24.375	24.25	24.45	24.50	24.50	25.50	23.50	24.357
Pig 99%	22.70	22.60	22.60	22.80	23.125	23.00	22.875	23.10	23.00	23.00	24.50	22.30	23.077
Lead (f.o.b. St. L.) c/lb. Duty 2½c/lb.	3.225	3.125	2.975	2.875	2.875	2.875	2.875	2.875	2.875	2.875	3.225	2.875	3.025
Aluminum c/lb. Duty 4c/lb.	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30
Nickel c/lb. Duty 3c/lb.													
Electrolytic 99.9%	35	35	35	35	35	35	35	35	35	35	35	35	35
Shot (from remelted electrolytic)	36	36	36	36	36	36	36	36	36	36	36	36	36
Pellets 99.5-100%	40	40	40	40	40	40	40	40	40	40	40	40	40
Antimony (Ch. 99%) c/lb. Duty 2c/lb.	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	6.25	5.75	5.959
Silver c/oz. Troy Duty Free	27.375	27.375	27.25	27.875	27.375	27.25	27.375	27.625	27.50	27.25	30.00	26.50	27.830
Platinum $/oz. Troy Duty Free	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	30.00	20.50	24.182

*Holiday.

Metal Prices, April 3, 1933

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

NEW METALS

Copper: Lake, 5.12½. Electrolytic, 5.00. Casting, 4.75.
Zinc: Prime Western, 3.00. Brass Special, 3.05.
Tin: Straits, 24.70. Pig, 99%, 23.15.
Lead: 2.875. Aluminum, 23.30. Antimony, 5.90.
Nickel: Ingot, 35. Shot, 36. Elec., 35. Pellets, 40.
Quicksilver: Flask, 75 lbs., $55. **Bismuth,** 85.
Cadmium, 55. **Silver,** Troy oz., official price, N. Y., April 3, 27.00.
Gold: oz., Troy, $20.67. **Platinum,** oz., Troy, $22 to $24.

Duties: Copper, 4c. lb.; zinc, 1¼c. lb.; tin, free; lead, 2½c. lb.; aluminum, 4c. lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

INGOT METALS AND ALLOYS

	Cents lb.	U. S. Duty	Import Tax*
Brass Ingots, Yellow	4 to 5¾	None	4c. lb.[1]
Brass Ingots, Red	5¼ to 8	do	do
Bronze Ingots	6 to11	do	do
Aluminum Casting Alloys	8 to22½	4c. lb.	None
Manganese Bronze Castings	16 to30	45% a. v.	3c. lb.[2]
Manganese Bronze Forgings	22 to33	do	do
Manganese Bronze Ingots	6¾to10	do	4c. lb.[1]
Manganese Copper, 30%	15 to22½	25% a. v.	3c. lb.[2]
Monel Metal Shot or Blocks	.. 28	do	None
Phosphor Bronze Ingots	6½to10	None	4c. lb.[1]
Phosphor Copper, guaranteed 15%	9½to15	3c. lb.[2]	do
Phosphor Copper, guaranteed 10%	9 to14	do	do
Phosphor Tin, no guarantee	30 to45	None	None
Silicon Copper, 10%	18 to30	45% a. v.	4c. lb.[1]
Iridium Platinum, 5%	$25-26	None	None
Iridium Platinum, 10%	$26-27	None	None

*Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.
[1]On copper content. [2]On total weight. "a. v." means ad valorem.

OLD METALS

Dealers' buying prices, wholesale quantities:	Cents lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed	3¼to 3⅜	Free	4c. per pound on copper content.
Light copper	2¾to 3	Free	
Heavy yellow brass	1¾to 1⅞	Free	
Light brass	1⅜to 1½	Free	
No. 1 composition	2⅜to 2½	Free	
Composition turnings	2¼to 2⅜	Free	
Heavy soft lead	2⅛to 2¼	2⅛c. lb.	
Old zinc	1⅛to 1⅜	1½c. lb.	
New zinc clips	1⅝to 1⅞	1½c. lb.	
Aluminum clips (new, soft)	10 to11	4c. lb.	
Scrap aluminum, cast, mixed	3¾to 4	4c. lb.	
Aluminum borings—turnings	2½to 3	4c. lb.	None.
No. 1 pewter	12¾to13¾	Free	
Electrotype or stereotype	1⅞to 2	2⅛c. lb.*	
Nickel anodes	23 to25	10%	
Nickel clips and turnings	18 to27	10%	
Monel scrap	6¼to10	10% a. v.	

*On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, small quantity, packing, etc., as shown in manufacturers' price lists, effective March 14, 1933.

COPPER MATERIAL

	Net base per lb.	Duty*
Sheet, hot rolled	13⅞c.	2½c. lb.
Bare wire, soft, less than carloads	8½c.	25% a. v.
Seamless tubing	12⅝c.	7c. lb.
Soldering coppers	15c.	45% a. v.

*Each of the above subject to import tax of 4c. lb. in addition to duty, under Revenue Act of 1932.

BRASS AND BRONZE MATERIAL

Net base prices per pound, mill shipments.

	High Brass	Low Brass	Bronze	Duty	
Sheet	11¼c.	12⅜c.	12¾c.	4c. lb.	U. S. Import Tax 4c. lb. on copper content
Wire	11¼c.	12⅜c.	12¾c.	25%	
Rod	8¾c.	12⅛c.	12½c.	4c. lb.	
Angles, channels	19¼c.		20¾c.	12c. lb.	
Seamless tubing	13½c.		15c.	8c. lb.	
Open seam tubing	19¼c.		20¾c.	20% a.v.	No tax.

NICKEL SILVER

Net base prices per lb. (Duty 30% ad valorem.)

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	19⅞c.	10% Quality	22¾c.
15% Quality	22c.	15% Quality	27⅛c.
18% Quality	23¼c.	18% Quality	30⅜c.

TOBIN BRONZE AND MUNTZ METAL

(Duty 4c. lb.; import tax 4c. lb. on copper content.)

Net base prices per pound.	
Tobin Bronze Rod	12½c.
Muntz or Yellow Rectangular sheet and other sheathing	13⅜c.
Muntz or Yellow Metal Rod	9¾c.

ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb.	32.30
Aluminum coils, 24 ga., base price	30.00

ROLLED NICKEL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods	50c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

MONEL METAL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

SILVER SHEET

Rolled sterling silver (April 3) 30.25c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

ZINC AND LEAD SHEET

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount	9.00	2c. lb.
Zinc sheet, full casks (jobbers' price)	9.25	2c. lb.
Zinc sheet, open casks (jobbers' price)	10.00to10.25	2c. lb.
Full Lead Sheet (base price)	6.75	2⅜c. lb.
Cut Lead Sheet (base price)	7.00	2⅜c. lb.

BLOCK TIN, PEWTER AND BRITANNIA SHEET

(Duty free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. or over .....15c. above N. Y. pig tin price
100 to 500 lbs. .....17c. above N. Y. pig tin price
Up to 100 lbs. .....25c. above N. Y. pig tin price

Lighter gauges command "extras" over the above prices.

Supply Prices, April 3, 1933

ANODES

Copper: Cast ..... 13½c. per lb.
Rolled, sheets, trimmed ..... 12¼c. per lb.
Rolled, oval ..... 11¾c. per lb.
Brass: Cast ..... 12¾c. per lb.
Zinc: Cast ..... 8½c. per lb.

Nickel: 90-92% ..... 42c. to 46c. per lb.
95-97% ..... 43c. to 47c. per lb.
99% cast, 45c. to 49c.; rolled, depolarized, 46c. to 50c.
Silver: Rolled silver anodes .999 fine were quoted April 3 from 30.25c., per Troy ounce upward, depending upon quantity.

WHITE SPANISH FELT POLISHING WHEELS

Diameter	Thickness	Under 50 lbs.	50 to 100 lbs.	Over 100 lbs.
10-12-14 & 16	1" to 2"	$2.85/lb.	$2.55/lb.	$2.35/lb.
10-12-14 & 16	2 to 3½	2.75	2.45	2.25
6-8 & over 16	1 to 2	2.95	2.65	2.45
6-8 & over 16	2 to 3½	2.90	2.60	2.35
6 to 24	Under ½	4.15	3.85	3.65
6 to 24	½ to 1	3.85	3.55	3.35
6 to 24	Over 3½	3.25	2.95	2.75

Any Quantity

4 to 6	Under ½, $4.90	½-1, $4.75	1 to 3, $4.65
1½ to 4	" 5.45	" 5.30	" 5.25
1 to ½	" 5.75	" 5.60	" 5.50

Extras: 25c. per lb. on wheels, 1 to 6 in. diam., over 3 in. thick.
On grey Mexican wheels deduct 10c. per lb. from above prices.

COTTON BUFFS

Full disc open buffs, per 100 sections when purchased in lots of 100 or less:

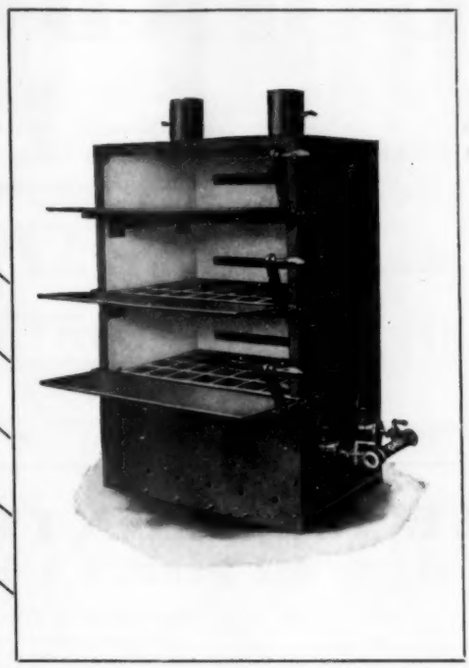
11" 20 ply 64/68 Unbleached	$14.49 to 16.60
14" 20 ply 64/68 Unbleached	24.28 to 27.40
11" 20 ply 80/92 Unbleached	16.61 to 18.85
14" 20 ply 80/92 Unbleached	27.83 to 31.10
11" 20 ply 84/92 Unbleached	20.33 to 25.05
14" 20 ply 84/92 Unbleached	34.04 to 41.95

Sewed Pieced Buffs, per lb., bleached ..... 30c. to 70c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.08-.09½
Acid—Boric (Boracic) granular, 99½+% ton lots	lb.	.04½-.05
Chromic, 75 to 400 lb. drums	lb.	.12-.17½
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30%, bbls.	lb.	.08-.12
Nitric, 36 deg., carboys	lb.	.06-.06½
Nitric, 42 deg., carboys	lb.	.07-.08
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	.10½-.12
Denatured drums	gal.	.475-.476
Alum—Lump, barrels	lb.	.03¼-.04
Powdered, barrels	lb.	.03½-.05
Ammonia, aqua, com'l., 26 deg., drums, carboys	lb.	.02¾-.05
Ammonium—Sulphate, tech., bbls.	lb.	.03½-.05
Sulphocyanide, technical crystals	lb.	.28-.37
Arsenic, white, kegs	lb.	.04½-.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.58
Borax, granular, 99½+%, ton lots	lb.	.02¼-.02¾
Cadmium oxide, 50 to 1,000 lbs.	lb.	.55
Calcium Carbonate (Precipitated Chalk)	lb.	.05¾-.07½
Carbon Bisulphide, drums	lb.	.05½-.12
Chrome Green, bbls.	lb.	.19
Chromic Sulphate	lb.	.30-.40
Copper—Acetate (Verdigris)	lb.	.20
Carbonate, bbls.	lb.	.14-.20
Cyanide (100 lb. kgs.)	lb.	.39
Sulphate, bbls.	lb.	2.75-5.25
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¼-.20½
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluorspar, bags	lb.	.03½
Gold Chloride	oz.	$12.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.32-.34
Iron Sulphate (Copperas), bbls.	lb.	.01½
Lacquer Solvents	gal.	.85
Lead—Acetate (Sugar of Lead)	lb.	.09-.13
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Methanol, 100% synth., drums	gal.	.41½
Nickel—Carbonate, dry, bbls.	lb.	.32
Chloride, bbls.	lb.	.16-.21
Salts, single, 300 lb. bbls.	lb.	.11-.13
Salts, double, 425 lb. bbls.	lb.	.11-.13
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.06¾-.08½
Potassium—Bichromate, casks (crystals)	lb.	.08
Carbonate, 96-98%	lb.	.06⅝
Cyanide, 165 lbs. cases, 94-96%	lb.	.50
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge—Nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.05-.05½
Silver—Chloride, dry, 100 oz. lots	oz.	.23-.27½
Cyanide (fluctuating)	oz.	.30-.37½
Nitrate, 100 ounce lots	oz.	.20-.23¾
Soda Ash, 58%, bbls.	lb.	.023
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.16½-.22
Beryllium fluoride ($2NaF.BeF_2$)	lb.	4.30-7.00
Hyposulphite, kegs, bbls.	lb.	.03½-.06½
Metasilicate, granular, bbls.	lb.	.03-.04
Nitrate, tech., bbls.	lb.	.03¼-.07
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass), bbls.	lb.	.01½
Stannate, fluctuating	lb.	.21½
Sulphocyanide	lb.	.30-.45
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, fluctuating, 100 lb. kegs	lb.	.24-.24½
Tripoli, powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc—Carbonate, bbls.	lb.	.11
Chloride, drums, bbls.	lb.	.07½-.10
Cyanide (100 lb. kegs)	lb.	.38
Sulphate, bbls.	lb.	.03½



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Vol. 31 MAY, 1933 No. 5

TABLE OF CONTENTS

Earning Profits in a Depression 157

Machining Aluminum 158
By W. B. FRANCIS

The Metal Manufacturing and Finishing Industries of the United States 159
What It Is; Who Buys Its Output; Who Provides It With Equipment and Supplies. A Survey of the Available Statistics of the American Industries Manufacturing Non-Ferrous Metal Products and Finishing All Metals; Also the Trades Which Consume These Products, and the Trades Furnishing Its Needs. Part 3.
By ADOLPH BREGMAN

Where Nickel Is Used in Industry 160

Platers' Meeting in Newark 161

Melting Equipment in the Non-Ferrous Industry 162
A Broad Consideration of All Types of Equipment for Various Needs. Factors Are Flexibility, Adaptability, Quality of Metal, Working Conditions and Costs.
By R. H. STONE

Melting Silver Chloride 165
By J. M.

Coating Metal with Rubber 165
By G. B. H.

Non-Ferrous Foundry Ingot Shapes 166
A Complete Description of the Characteristics Demanded of Ingots for Foundry Use. Practical Reasons for the Various Shapes Used. Visual Inspection Important.
By PIERCE BARKER

Plated vs. Solid Metals 167
By A. K. G.

A Cost Analysis of Zinc Die Castings vs. Machined Castings 168
By L. H. MORIN

Electroplating Zinc on Aluminum 169
Electroplates of Zinc Electrochemically Protect Aluminum from Corrosion—Zinc Electroplates Have Been of Value Where Properties of the Zinc Other Than Corrosion Resistance are Desired.
By HAROLD K. WORK

Metals and Finishes in New Applications 171

Editorials 172

Shop Problems 174

Patents 176

Equipment 177
Riverside Beryllium Copper.
New Boiler Feed Unit.
Lining for Burnishing Barrels.
Radiation Tube.
Powdered Solder—Correction.
New Electron Tube Device Locates Cracks in Wire and Tubing.
Small Fast Grinder.
Manufacturing Jewelers' Equipment.
Automatic Weighing of Small Parts.
Pack-Morin, Inc.

Personals 179

Obituaries 180

News of Associations and Societies 181

Industrial and Financial News 182

Metal Market Review 187

Wrought Metal Market 188

Metal Prices 188

Supply Prices 190

METAL INDUSTRY articles are listed regularly in the "Engineering Index" and "The Industrial Arts Index"

Buyers' Guide, Advertising Page 27